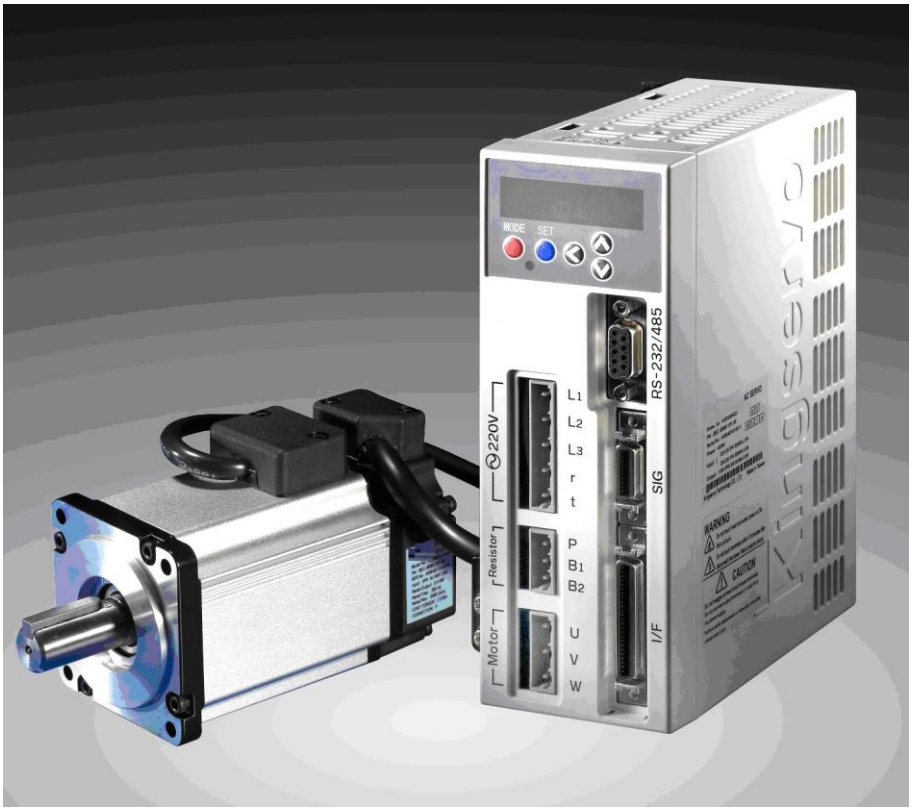
Mokon-K Series Driver
User's Manual



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Correction record

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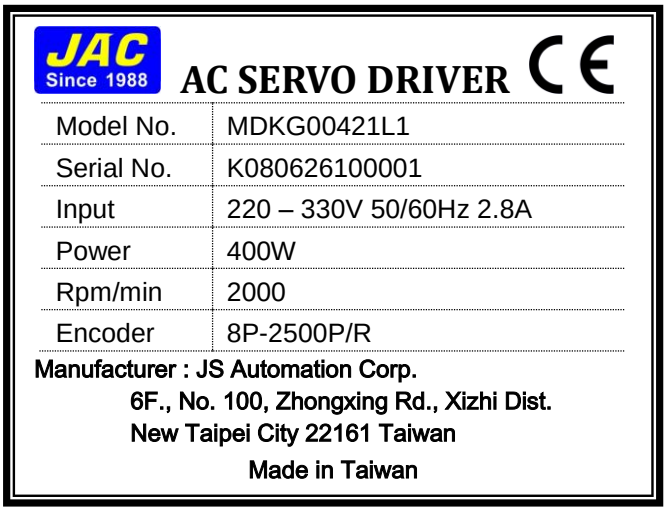
1. Checking Mokon-K series products on delivery

Check the following items when Mokon-K Series products are received:
- 1. Check the packed products for damages that may have occurred during shipping.
- 2. Check whether the name and number of the delivered products are the same as those on the delivery sheet.
- 3. Check whether the servomotor and servo drive capacity and encoder specification are the same as the ordered.
- 4. In the case of special order, please carefully check the delivered products and contact our company immediately if any item is incorrect.

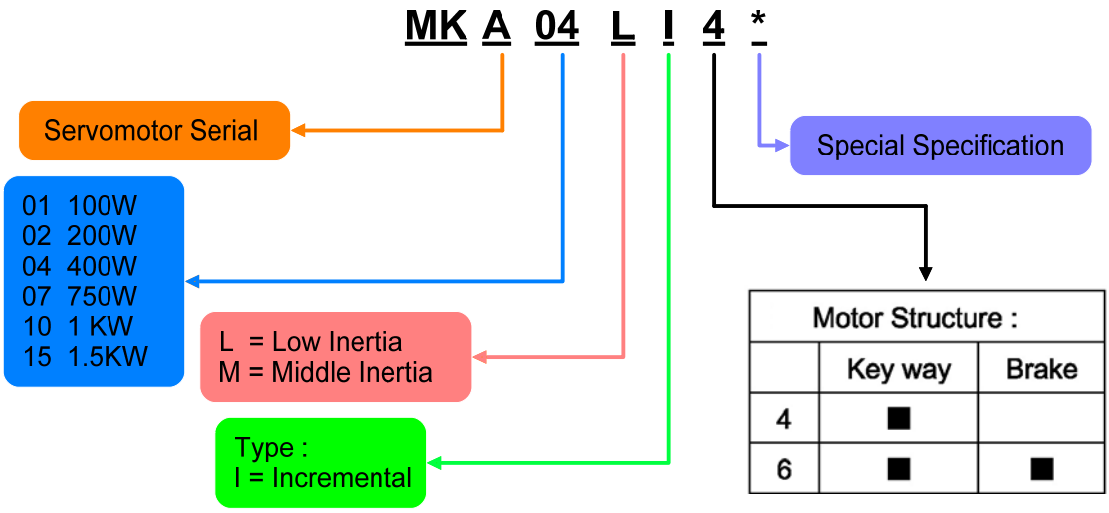
The following items are included in the standard set:
- 1. One servomotor.
- 2. One servo drive
- 3. One 50PIN SCSI-ii type connector for I/F*
- 4. One 20PIN SCSI-ii connector for SIG*
- 5. One connector for servomotor power line*
- 6. One encoder connector*

* If cable is your option, they will be soldered ready with the cable.

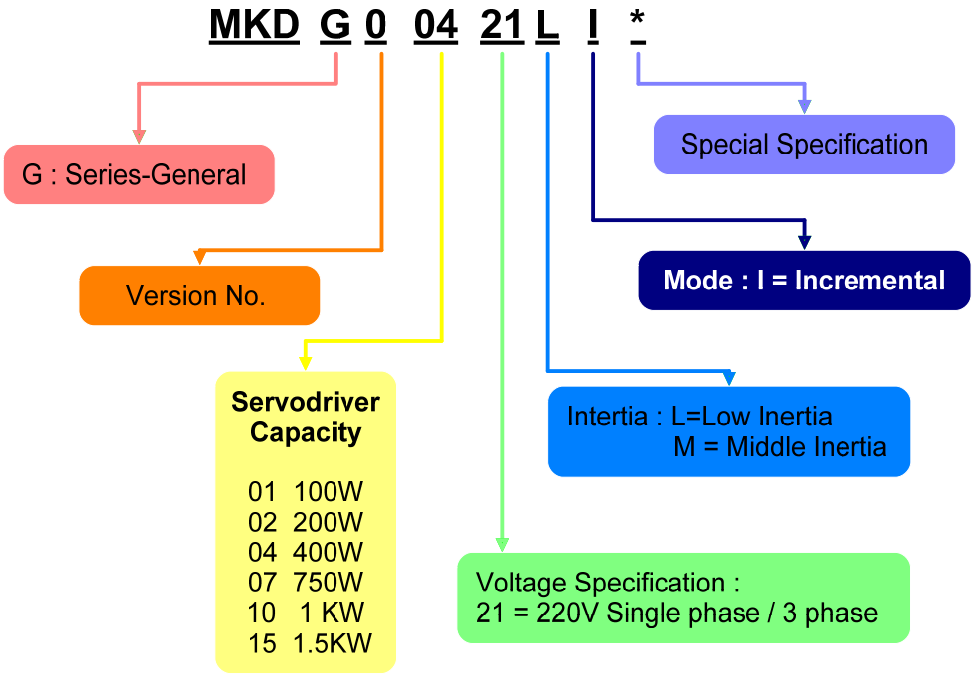
1.1 Servomotor nameplate descriptions



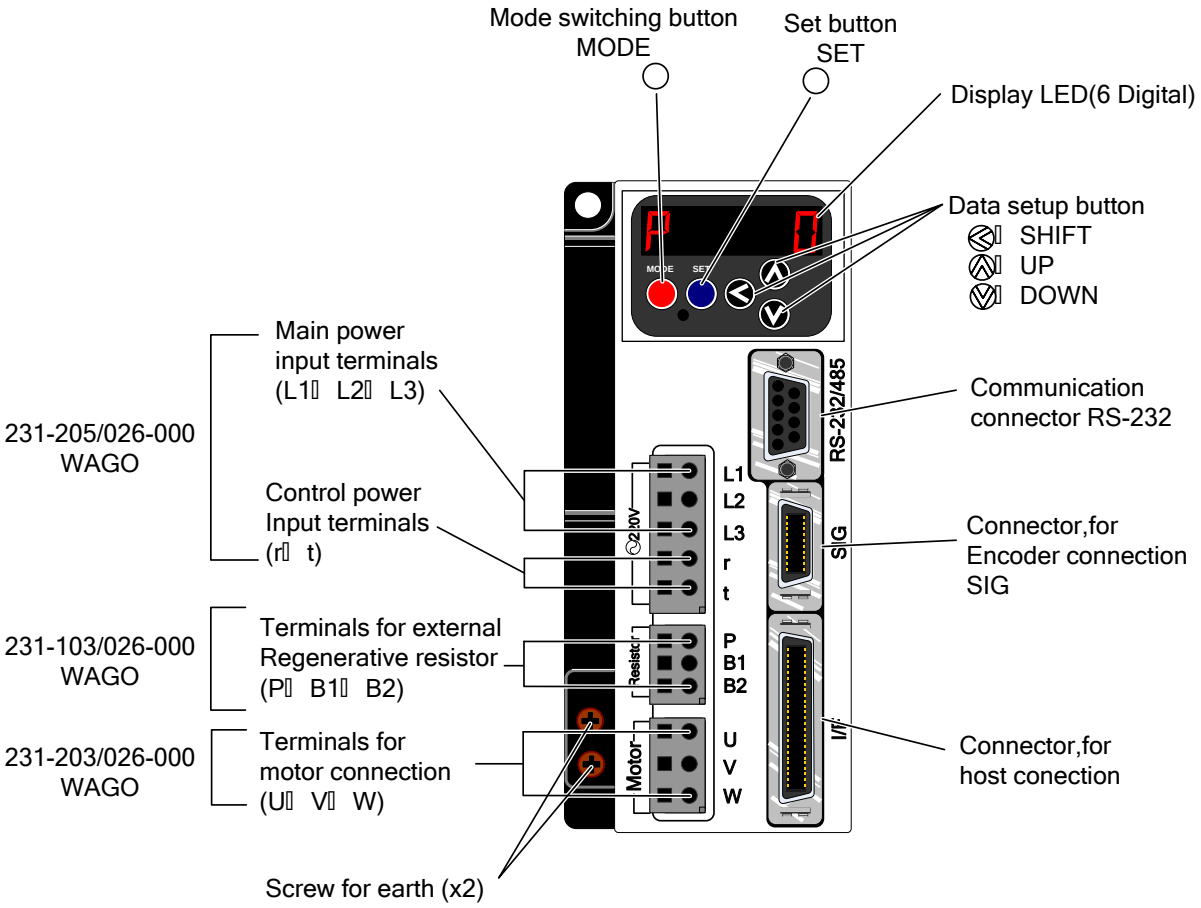
1.2 Servomotor model naming



1.3 Servo drive model naming

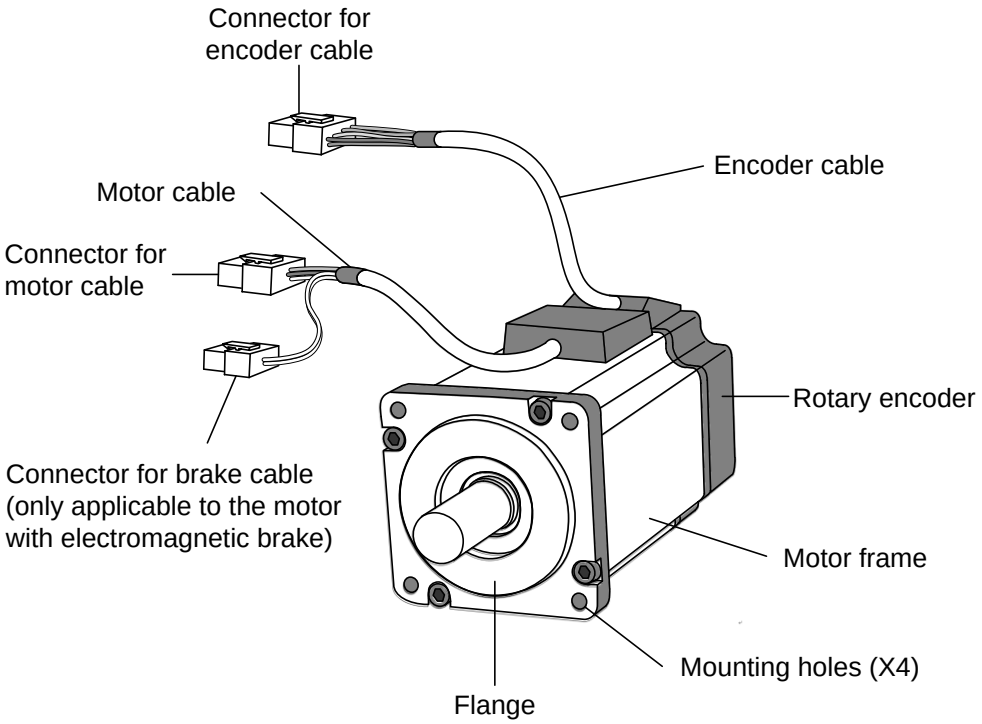


1.4 Servo drive part names

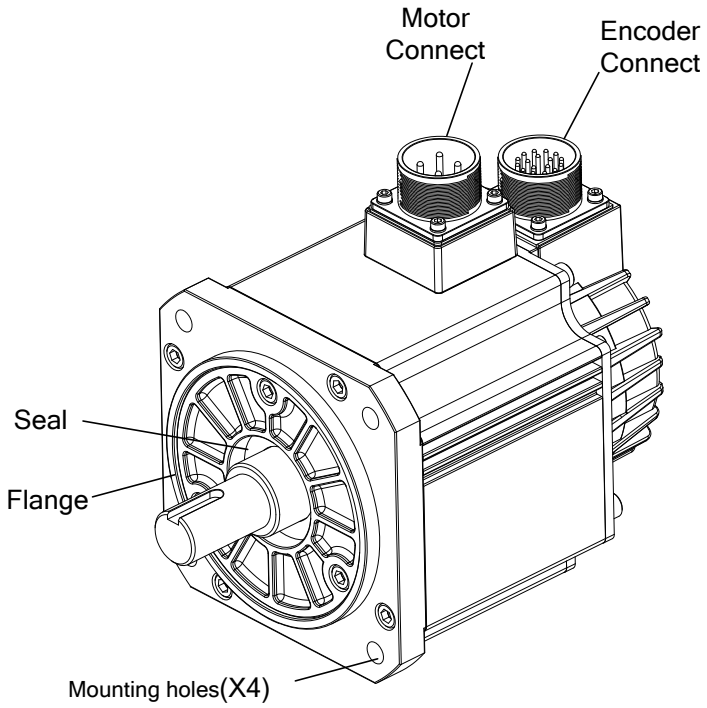


1.5 Motor and it accessories

MKA 200W～750W



MKA 1000W～2000W



2. Servo drive installation precautions

2.1 Ambient conditions

The servo drive should be stored in the environment within ambient conditions as following table shown:

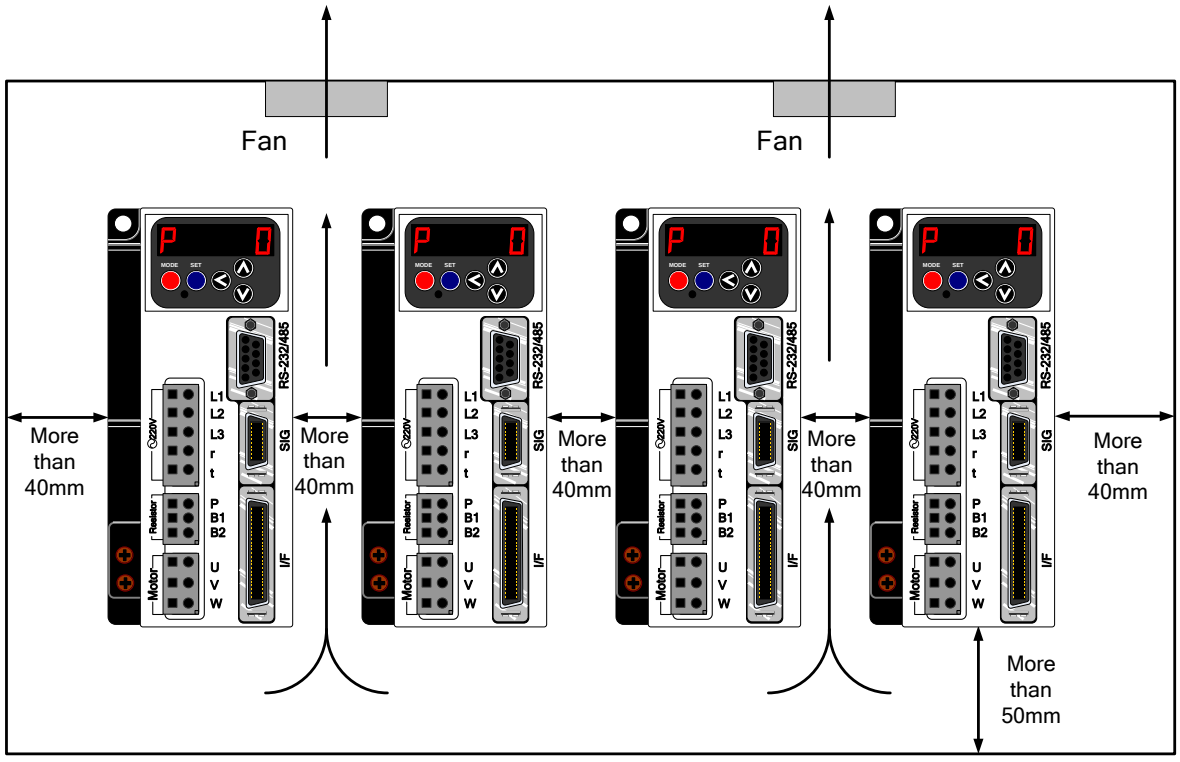
Item	Condition
Ambient temperature	0℃ to 55℃ (free from freezing)
Ambient humidity	Less than 90% RH (free from condensation)
Storage temperature	–20℃ to 80℃ (free from freezing)
Storage humidity	Less than 90% RH (free from condensation)
Vibration	Lower than 5.9m/S2 (0.6G), 10 to 60Hz

2.2 Installation Orientation and Spacing

- 1. When installing the servo drive, make the front panel containing connectors face outward and take into consideration the easy connection/disconnection of I/F and SIG connectors for measurement.

2.3 Servo drive Installation and Cooling Method

For multiple servo drives installation in the control cabinet, allow at least 40mm between each. When installing servo drives side by side as shown in the figure below, allow at least 50mm allowance above and below each servo drive or install cooling fans to facilitate air circulation.



2.4 Prevent foreign object intrusion

- 1. Prevent the drilling and cutting chips from entering the servo drive during installation and operation.
- 2. Avoid the odd objects like oil water and metal powder from entering the servo drive via cooling fans.
- 3. If using fans for cooling, please install the filter properly at the ventilating hole, and consider the surrounding environment to choose the best direction for ventilation.
- 4. Please install heat exchanger or air filtering system when installing in locations subject to poisonous gas or excessive dust.

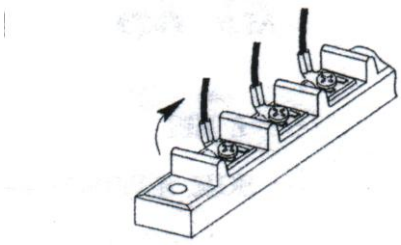
Extra Notices:

1. Do not install the servo drive in locations likely to be affected by oil and dust. If unavoidable, please install the Servo drive in the airtight control cabinet and consider using ventilation filter. Also use a protective cover over the Servomotor.
2. When installing multiple servo drives in one airtight control cabinet, allow at least 50mm between, above and below each servo drive and leave 120mm for maintenance space. In addition, to ensure the reliability and improve the product life, leave certain distance between the servo drive and the cabinet ceiling so the temperature around the servo drive does not exceed 55°C which might lead to poor ventilation.
3. A frequent use of the regenerative resistor may lead to a temperature higher than 100 °C. Do not put inflammables or heating deformable objects around. The wirings must also be kept away from the resistor or severe damage will occur.
4. When installing near a source of vibration, install a vibration isolator to protect the Servo drive from vibration.

3. Servo drive wiring precautions

3.1 Main wiring

- 1. Apply three-phase 220V AC mains through the NFB to the magnetic contactor then connect to the servo drive RST terminals. Consider installing a reactor and linear noise filter if the local power supply quality is poor.
- 2. Connect the UVW terminals of the servo drive with the red, white and black cable lines of the servomotor directly or via terminal board, on which the cable lines be secured with a terminal plier and wrapped tightly to avoid incidental short-circuit, power interruption or earth faults.
- 3. Make sure the cable lines are not damaged under stress. Be cautious of the cable wiring to avoid as much as possible being subject to bending or tension.
- 4. If the servomotor is moving with the mechanism, arrange the bending section of the cable line within the allowable curvature which is determined from the cable specification to assure normal operation life.
- 5. Make sure the cable lines are not touched by sharp parts of the machine or pressed by any heavy object.
- 6. Provide proper grounding wiring for the ground terminals of the servo drive and servomotor.
- 7. H1 and H2 are the thermostat terminals for the servomotor. Strictly forbid to short circuit them with the machine bed or falsely connect with U V W E terminals.
- 8. After fastening the main terminal board, the ends of the wiring terminals can be bended up to be kept away from the front nameplate as shown be



3.2 Wiring for the controller and the encoder

- 1. Each pin of I/F connector and SIG connector must be soldered and checked carefully for correct pin number Check the adjacent pins after soldering to avoid being incidentally shorted circuit by the solder or unused leads.
- 2. Wrap the soldered leads with shrinkable tubes to keep from being touched by each other.
- 3. If the leads from SIG connector must be extended, care must be taken in the connection section and proper shielding measures must be adopted to suppress EMI noise.
- 4. Do not stretch tight the leads of SIG connector to avoid wiring faults of the encoder.
- 5. Power cables and signal lines should not be arranged in close parallel, and the leads for control signals should be twisted and shielded.

Note: Be cautious of the length of the wiring and the measures for noise shielding if Mokon-K series is used in position control mode. If not using the line driver type, the PULSE GND must be connected to DGND, or the lost pulse fault may occur.

1. Do not bundle power and signal lines together in the same duct. Leave at least 30cm (11.81 in.) between power and signal lines.
2. Use twisted-pair wires or multi-core shielded-pair wires for signal and encoder (PG) feedback lines.
3. The maximum length for signal input lines is 3m (118.11 in.) and for PG feedback lines is 20m (787.40 in.).
4. Do not touch the power terminals for 5 minutes after turning power off because high voltage may still remain in the servo drive.
5. Make sure the Charge Indicator is out before starting an inspection.
6. Avoid frequently turning power on and off. Do not turn power on or off more than once per minute.
7. Since the servo drive has capacitors in the power supply, a high charging current flows for 0.2 seconds when power is turned on. Frequently turning power on and off will cause main power devices like capacitors and fuses to deteriorate, resulting in unexpected problems.

4. Servomotor installation precautions

4.1 Installation precautions of environment

Since the conditions of location affect a lot to the motor life, please choose the installation location meets the following conditions.

Installation in the room where avoid the sun, or easy to damp places.

- 1. Do not set up in easily accessible to hydrogen sulfide, chlorine, ammonia, sulfur, chloride, sulfide, pH, chlorine and other corrosive gases, or gas fire is guide the Department, or flammable material near use.
- 2. Where the motor is free from grinding oil, oil mist, iron powder or chips
- 3. Well-ventilated and humid and dust-free place, far apart from the heat source such as a furnace.
- 4. Easy-to-access place for inspection and cleaning.
- 5. Vibration-free place.
- 6. Avoid enclosed place. Motor may get hot in those enclosure and shorten the motor life.

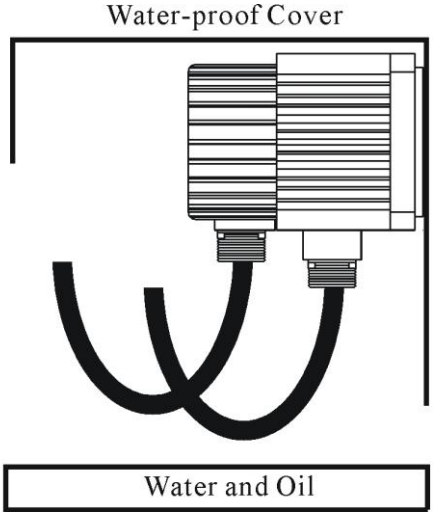
Item		Condition
Ambient temperature		0℃ to 40℃ (free from freezing) *1
Ambient humidity		Less than 85% RH (free from condensation)
Storage temperature		–20℃ to 80℃ (free from freezing) *2
Storage humidity		Less than 85% RH (free from condensation)
Vibration	Motor only	Lower than 49m/s2 (5G) at running, 24.5m/s2 (2.5G) at stall
Impact	Motor only	Lower than 98m/s2 (10G)
Enclosure rating	Motor only	IP65 (except rotating portion of output shaft and lead wire end) These motors conform to the test conditions specified in EN standards (EN60529). Do not use these motors in application where water proof performance is required such as continuous wash-down operation.

*1 Ambient temperature to be measured at 5cm away from the motor.

*2 Permissible temperature for short duration such as transportation.

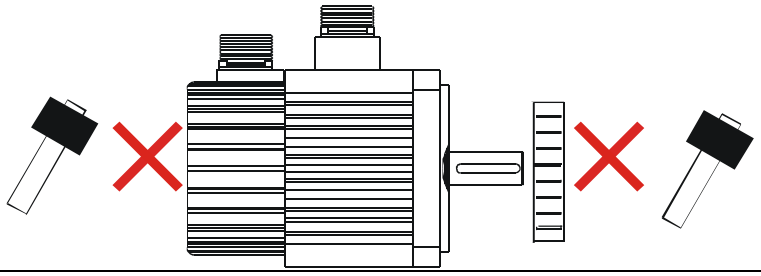
Try to avoid water and oil exposure since the servomotor contains no water-proof structure. Install a water-proof cover if it is used in a location that is subject to water or oil.

- 1. Servomotor cable line facing downward can prevent the oil and water from entering the servomotor via cable line.
- 2. If the servomotor is installed vertically or with a slope, the cable line should be bended to U-type to avoid the oil and water from entering via the cable line.
- 3. Carefully avoid the exposure of cable lines to oil and water that have adverse effects on servomotor and encoder, also may cause malfunctions of the servo drive.



4.2 Connect the servomotor with load precautions

- 1. To mount a belt wheel, use the set screw to secure it on the shaft end if the motor shaft has a keyway; Use a friction coupling if the motor shaft has no key way.
- 2. Use a special tool to dismantle the belt wheel, avoiding impact to the shaft.
- 3. Strictly forbid to exert force on the back cover of the encoder by hands or ropes when moving the servomotor.
- 4. Strictly forbid the use of hammer to strike the shaft (likely to damage the encoder)

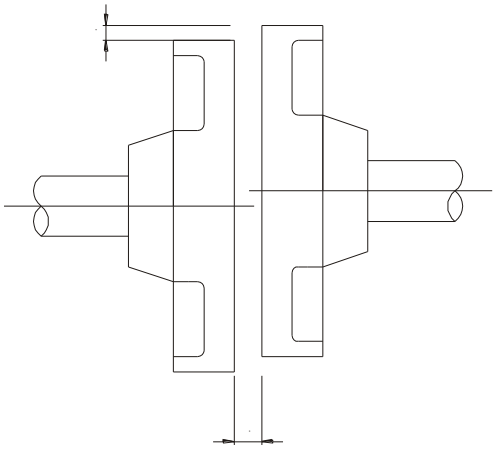


Avoid violent collision and vibration of servomotor when mounting a belt wheel or a clutch! The encoder connecting with the shaft is vulnerable under intense vibration which may adversely affect the resolution and service life of the servomotor.

- 5. Do not change the encoder wiring direction.
- 6. Use a flexible connector. The round-off must meet with the allowable radial load.
- 7. Choose a proper pulley, chain wheel or timing belt that can meet with the requirement of the allowable radial load.
- 8. If the servomotor is attached with a magnetic brake, either horizontal or vertical installation is allowed. When the shaft is upward installed, the brake may normally make some noise.

4.3 Alignment

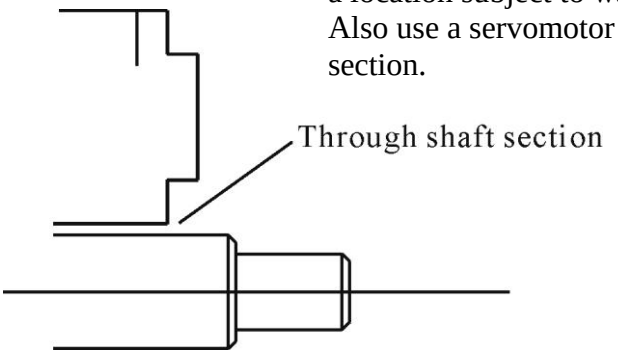
Align the shaft of the servomotor with the shaft of the apparatus, and then couple the shafts. Install the servomotor so that alignment accuracy falls within the following range.



Measure this distance at four different positions around. The difference between the maximum and minimum measurements must be below 0.03mm (0.0012 in). (Turn together with the coupling.)

4.4 Handling oil and water

Install a protective cover over the servomotor if it is used in a location subject to water or oil mist.
Also use a servomotor with an oil seal to seal the through shaft section.

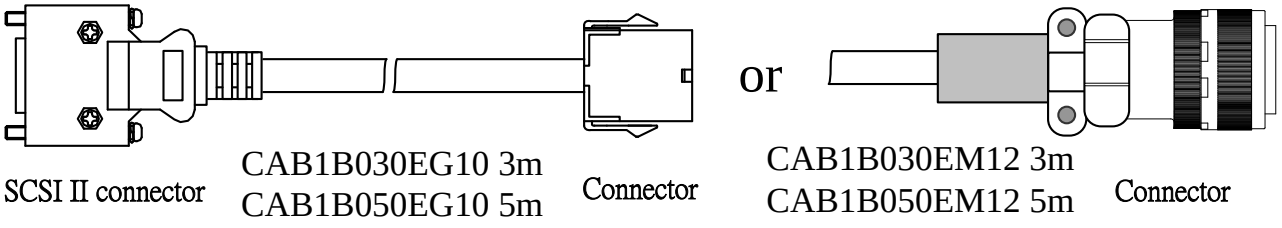


4.5 Cable stress

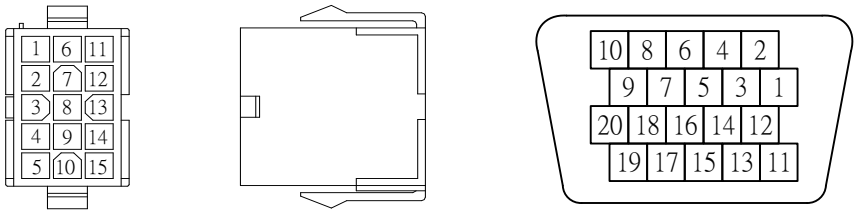
Make sure there are no bends or tension on the power lines.
Be especially careful to signal line wiring to avoid stress because the diameter of the core wires is only 0.2 to 0.3mm (0.0079 to 0.012 in).

5. Encoder wiring and SIG connector pin assignments

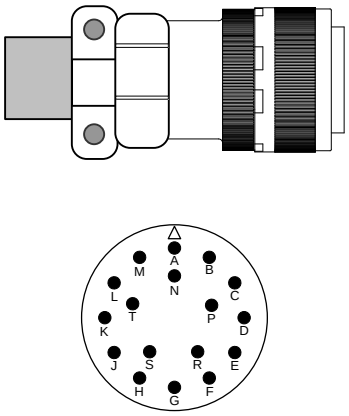
5.1 Cable of Encoder

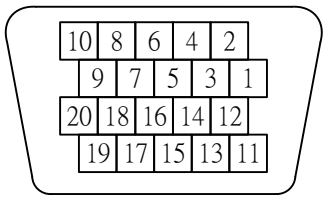


5.2 Connector and pin definitions



15 PIN Connector	Cable Color	Name of the Signal	SCSI ii connector
1	Red	A	7
2	Green	/A	8
3	Black	B	9
4	White	/B	10
5	Yellow	Z	11
6	Blue	/Z	12
7		NC	
8		NC	
9		NC	
10		NC	
11	Gray	RX	17
12	Orange	/RX	18
13	Brown/ Light RED	Vcc	3/4
14	Purple/ Light Green	GND	1/2
15	Grounding Line of Isolation Net	FG	20



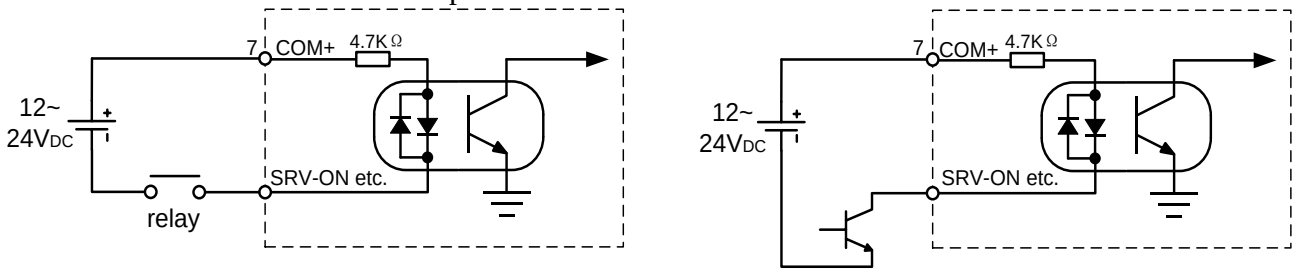


17 PIN Connector	Cable Color	Name of the Signal	Servo drive Side SCSI ii connector
A	Red	A	7
B	Green	/A	8
C	Black	B	9
D	White	/B	10
E	Yellow	Z	11
F	Blue	/Z	12
G	Purple/ Light Green	GND	1/2
H	Brown/ Light RED	Vcc	3/4
J	Grounding Line of Isolation Net	FG	20
K		NC	
L		NC	
M		NC	
N		NC	
P	Gray	RX	17
R	Orange	/RX	18
S		NC	
T		NC	

6. Input circuit

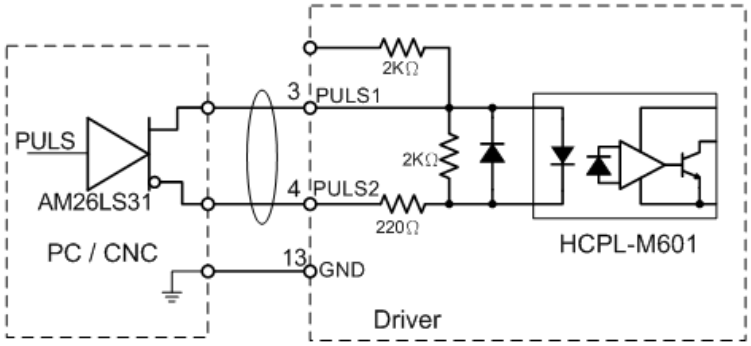
Digital input

6.1 Photo-isolated control input



Generally sequence input signals use 12-24Vdc voltage; you can connect contacts of switches, relays or open collector output transistors to control the input.

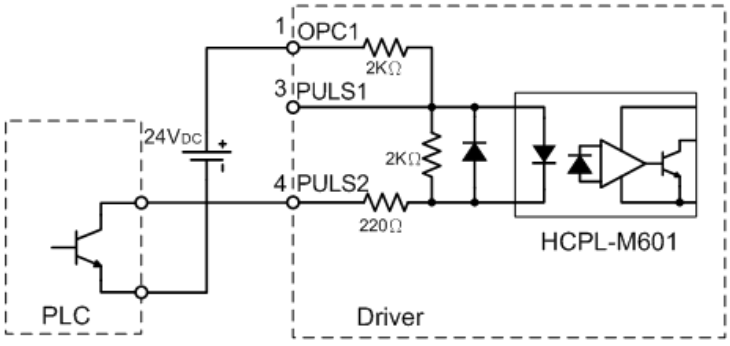
6.2 Pulse command input circuit (photo-coupled)



Line driver I/F (Input pulse frequency: max. 500kpps)

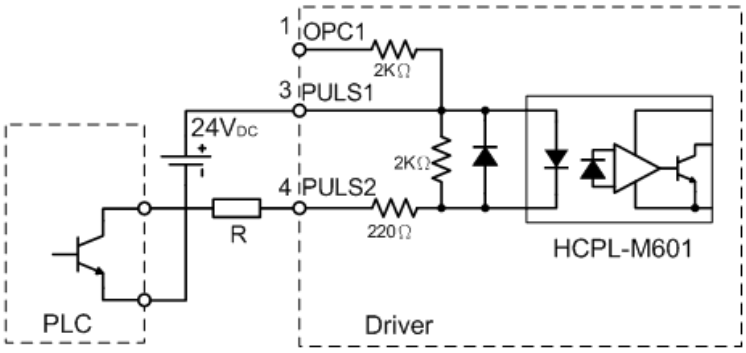
We recommend this to secure the signal transmission since this method has better noise immunity.

represents twisted pair.



Open collector I/F (Input pulse frequency: max. 200kpps)

Connect to dedicated input with build-in resistor.

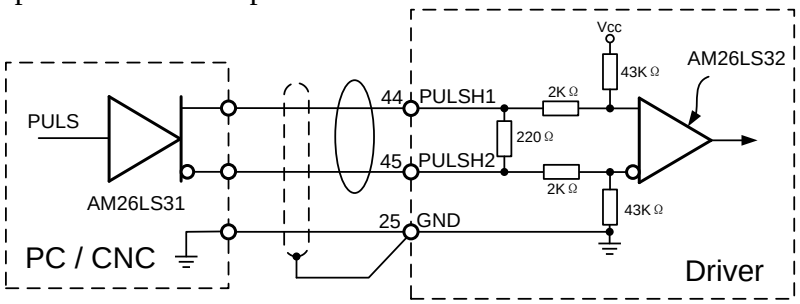


Open collector I/F with external resistor (Input pulse frequency: max. 200kpps)

V_{DC}	Specifications
12V	1KΩ 1/2W
24V	2KΩ 1/2W

$$\frac{V_{DC} - 1.5}{R+220} \fallingdotseq 10mA$$

6.3 Line driver pulse command input



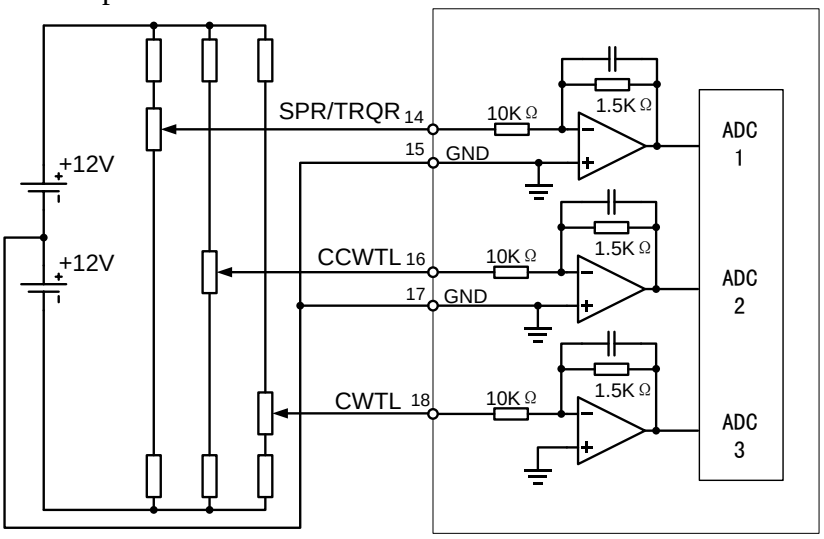
exclusive line driver pulse train input (Input pulse frequency: max. 2Mpps)

This signal transmission method has better noise immunity. We recommend this to secure the signal transmission.

represents twisted pair.

Analog input

6.4 Analog command input circuit

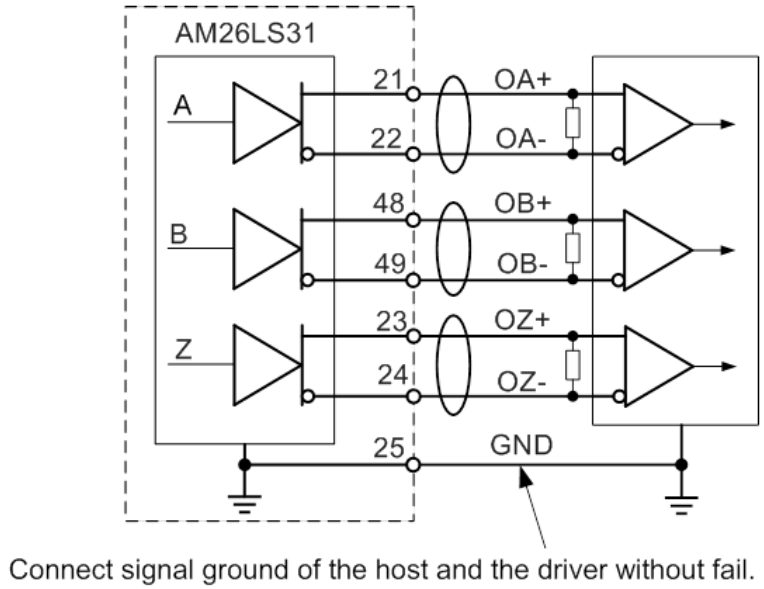


There are 3 12bit analog inputs: SPR/TRQR(Pin-14), CCWTL (Pin-16) and CWTL (Pin-18).
The Max. permissible input voltage to each input is ±10V.

7. Output circuit

Digital output

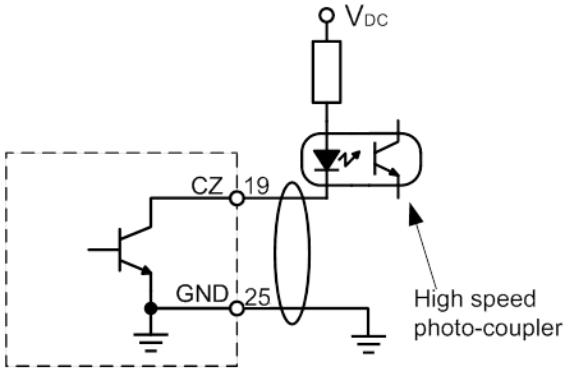
7.1 Encoder output interface



The encoder signal outputs are differential type for high speed signals. On the host receiver side, the line receiver circuit is recommended. But on some occasion, single end can also be used on either + or – output.

represents twisted pair.

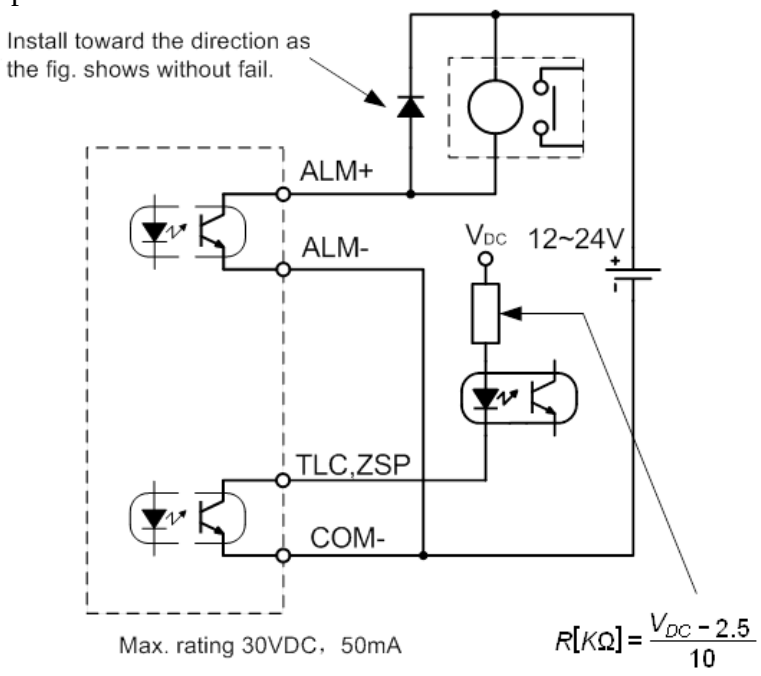
7.2 Open collector output



The encoder Z-phase signal output is an open collector type. This output is not insolated. Be sure to receive this output with high-speed photo couplers at the host side, since the pulse width of the Z-phase signal is narrow.

represents twisted pair.

7.3 Sequence output circuit

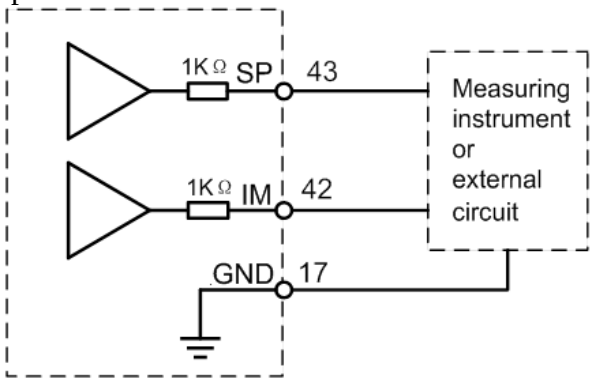


The sequence control output circuit is isolated open collector outputs; they are suitable to connect to relays or photo-couplers.

If used as collector drive, the wiring is recommended as above diagram; the current limit resistor can be calculated as formula shown (the voltage drop of photo coupler transistor and receiver input diode assumes 2.5V; the current limits to 10ma).

If used as emitter follower, the diagram is recommended as follows; the current limit resistor can be calculated as formula shown (the voltage drop of photo coupler transistor and receiver input diode assumes 2.5V; the current limits to 10ma).

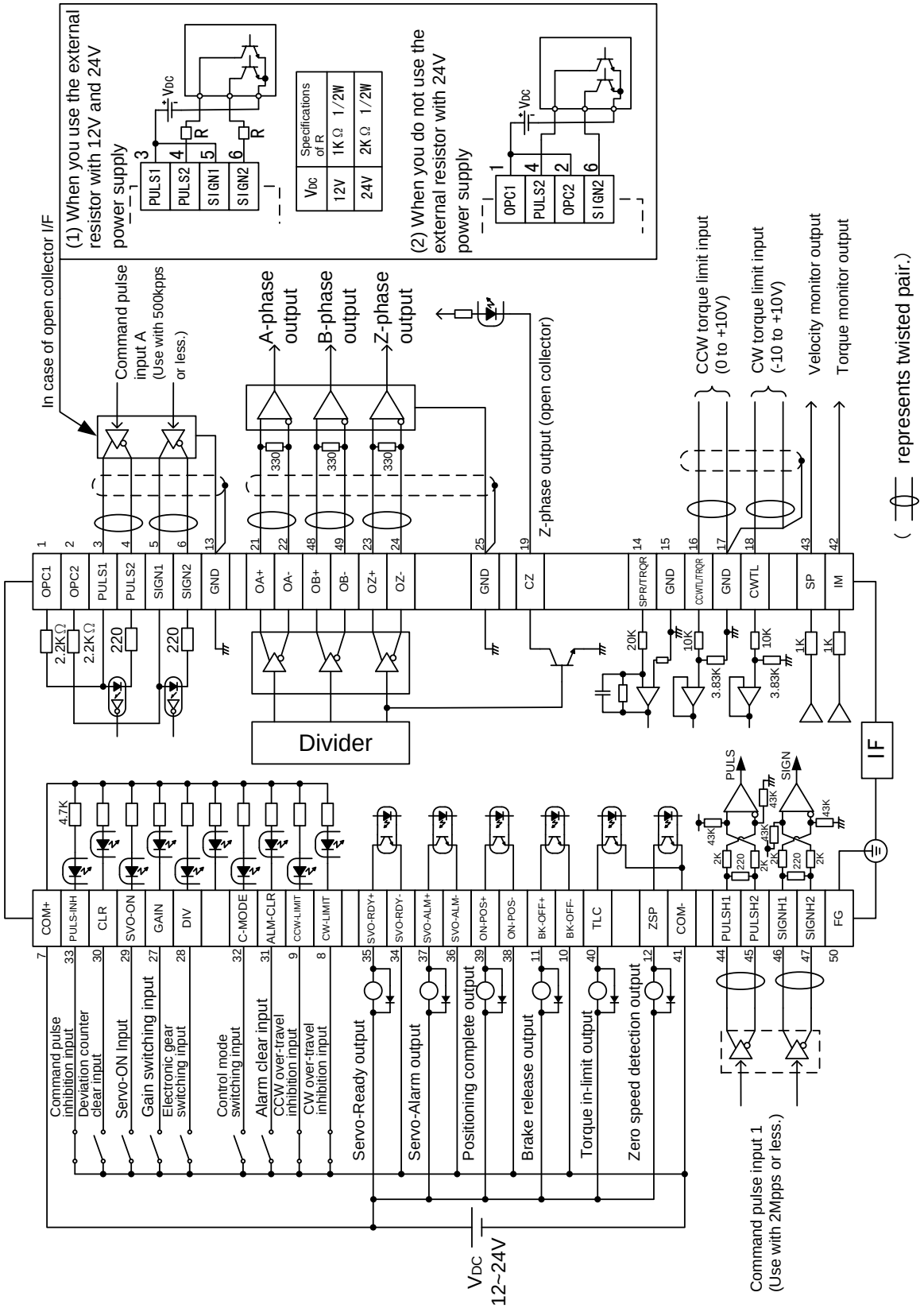
7.4 Analog monitor output



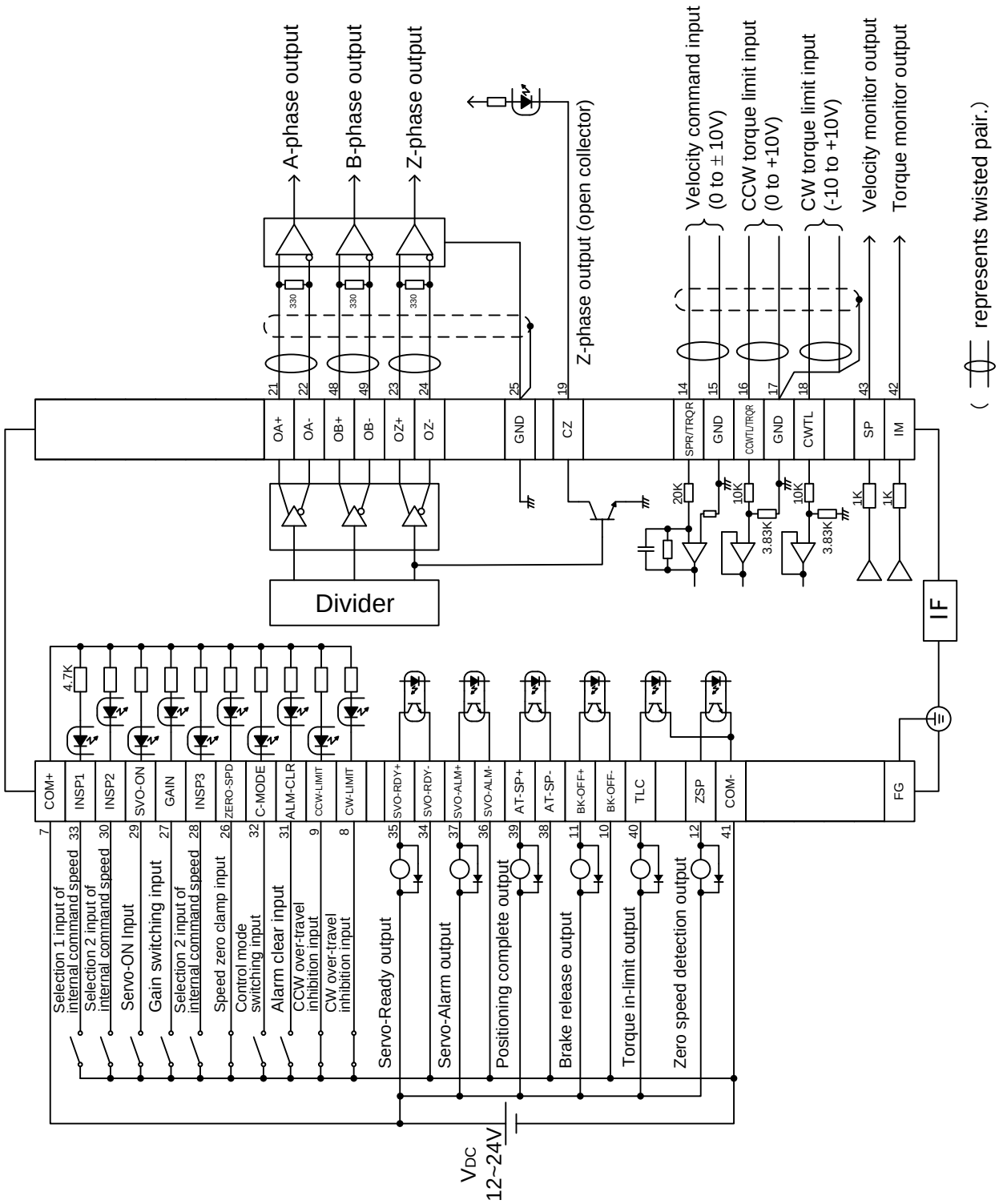
There are two outputs, the speed monitor signal output (SP) and the torque monitor signal output (IM), the signal range is ±10V. The output impedance is 1kΩ. Pay an attention to the input impedance of the measuring instrument or the external circuit to be connected.

8. Wiring diagram

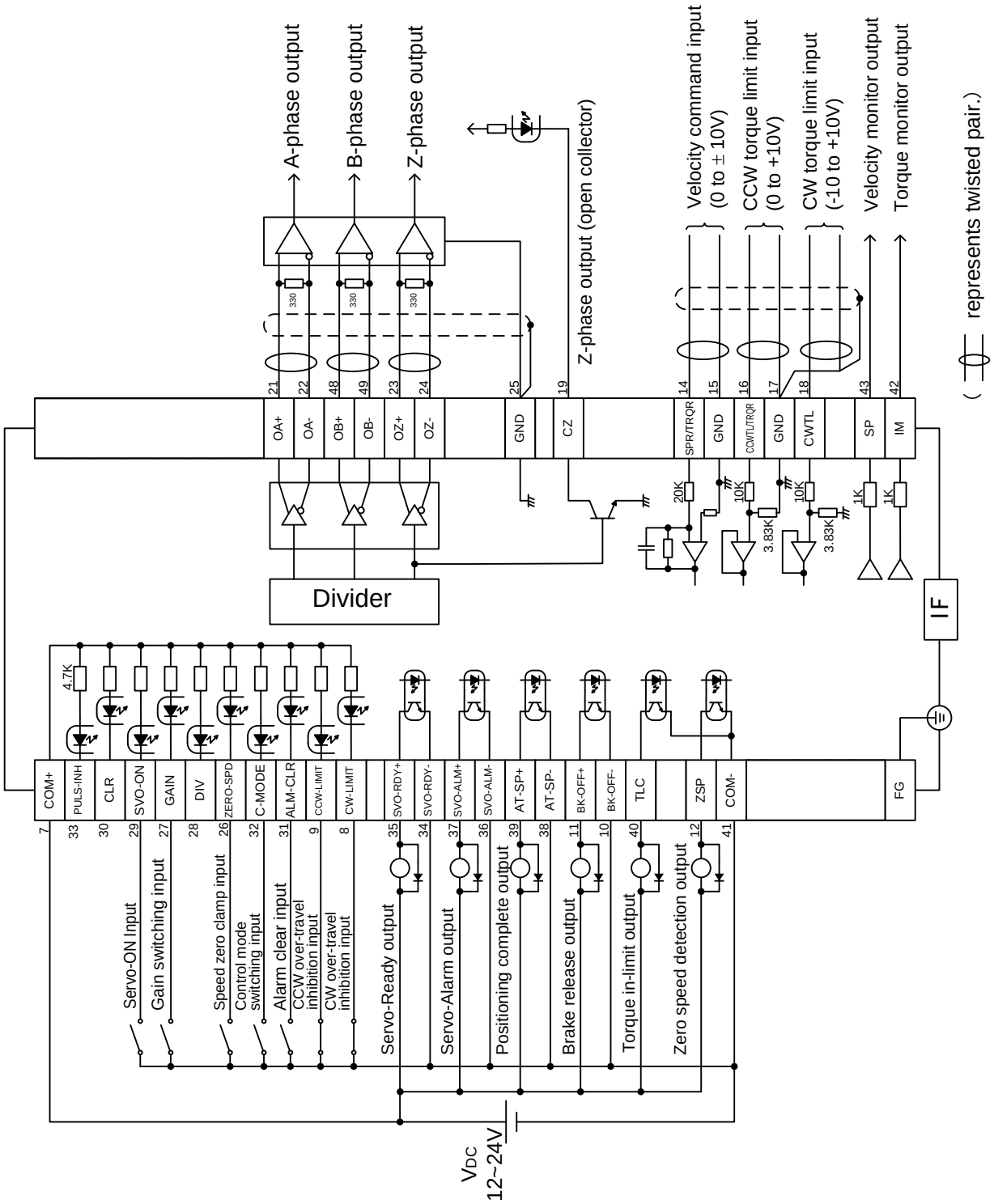
8.1 Position control



8.2 Velocity control



8.3 Torque control



9. Digital input signals and their functions

9.1 Inputs common to all function mode

<table>
<tr><th>Signal Type</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td rowspan="6">Position/ Velocity/ Torque</td><td>7</td><td>COM+</td><td>• Connect + of the external DC power supply (12 to 24V).
• Use the power supply voltage of 12V ± 5% – 24V ± 5%</td></tr>
<tr><td>41</td><td>COM-</td><td>• Connect – of the external DC power supply (12 to 24V).
• The power capacity varies depending on a composition of I/O circuit. 0.5A or more is recommended.</td></tr>
<tr><td>8</td><td>CW-LIMIT</td><td>CW over-travel protection input
• Use this input to inhibit a CW over-travel (CWL).
• Connect this so as to make the connection to COM– open when the moving portion of the machine over-travels the movable range toward CW.
• CWL input will be invalidated when you set up Pr04 (Setting of over-travel inhibit input) to 1.Default is "Invalid (1)".
• You can select the action when the CWL input is validated with the setting of Pr66 (Sequence at over-travel protection). Default is "Emergency stop with dynamic brake".(Pr66=0)</td></tr>
<tr><td>9</td><td>CCW-LIMIT</td><td>CCW over-travel protection input
• Use this input to inhibit a CCW over-travel (CCWL).
• Connect this so as to make the connection to COM– open when the moving portion of the machine over-travels the movable range toward CCW.
• CWL input will be invalidated when you set up Pr04 (Setting of over-travel inhibit input) to 1.Default is "Invalid (1)".
• You can select the action when the CCWL input is validated with the setting of Pr66 (Sequence at over-travel inhibit). Default is "Emergency stop with dynamic brake".(Pr66=0)</td></tr>
<tr><td>31</td><td>ALM-CLR</td><td>Alarm clear input
• You can release the alarm status by connecting this to COM– for more than 120ms.
• The deviation counter will be cleared at alarm clear.
• There are some alarms which cannot be released with this input.</td></tr>
<tr><td>32</td><td>C-MODE</td><td>Control mode switching input
• You can switch the control mode as below by setting up Pr02 (Control mode setting) to 3-5.
<table>
<tr><th>Pr02 setting</th><th>Open (1st)</th><th>Connection to COM– (2nd)</th></tr>
<tr><td>3</td><td>Position control</td><td>Velocity control</td></tr>
<tr><td>4</td><td>Position control</td><td>Torque control</td></tr>
<tr><td>5</td><td>Velocity control</td><td>Torque control</td></tr>
</table>
<Caution>
Depending on how the command is given at each control mode, the action might change rapidly when switching the control mode with C-MODE. Pay an extra attention.</td></tr>
</table>

9.2 Torque mode related input

<table>
<tr><th>Signal Type</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td rowspan="2">torque</td><td>26</td><td>ZERO-SPD</td><td>• Function varies depending on the control mode.
• Becomes to a speed-zero clamp input (ZEROSPD).
<table>
<tr><th>Pr06</th><th>Connection to COM–</th><th>Content</th></tr>
<tr><td>0</td><td>—</td><td>ZERO-SPD input is invalid</td></tr>
<tr><td rowspan="2">1</td><td>open</td><td>Speed command is 0</td></tr>
<tr><td>Close</td><td>Normal action</td></tr>
<tr><td rowspan="2">2</td><td>open</td><td>invalid</td></tr>
<tr><td>Close</td><td>invalid</td></tr>
</table></td></tr>
<tr><td>27</td><td>GAIN</td><td>Torque limit switching input
• Function varies depending on the settings of Pr30 (2nd gain setting) and Pr03 (Selection of torque limit).
<table>
<tr><th>Pr 0</th><th>Connection to COM–</th><th>Content</th></tr>
<tr><td rowspan="2">0</td><td>Open</td><td>Velocity loop : PI (Proportion/Integration) action</td></tr>
<tr><td>Close</td><td>Velocity loop : P (Proportion) action</td></tr>
<tr><td rowspan="5">1</td><td colspan="2">when the settings of Pr31,Pr36 and 3A are 2</td></tr>
<tr><td>Open</td><td>1st gain selection (Pr10,11,12,13 and 14)</td></tr>
<tr><td>close</td><td>2nd gain selection (Pr18,19,1A,1B and 1C)</td></tr>
<tr><td colspan="2">when the settings of Pr31,Pr36 and 3A are 2</td></tr>
<tr><td colspan="2">invalid</td></tr>
</table></td></tr>
</table>

9.3 Velocity mode related inputs

<table>
<tr><th>Signal Type</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td rowspan="3">velocity</td><td>26</td><td>ZERO-SPD</td><td>• Function varies depending on the control mode.
• Becomes to a speed-zero clamp input (ZEROSPD).
<table>
<tr><th>Pr06</th><th>Connection to COM–</th><th>Content</th></tr>
<tr><td>0</td><td>—</td><td>ZERO-SPD input is invalid.</td></tr>
<tr><td rowspan="2">1</td><td>open</td><td>Speed command is 0</td></tr>
<tr><td>Close</td><td>Normal action</td></tr>
<tr><td rowspan="2">2</td><td>open</td><td>Speed command is to CCW</td></tr>
<tr><td>Close</td><td>Speed command is to CW.</td></tr>
</table></td></tr>
<tr><td>27</td><td>GAIN</td><td>Gain switching input
• Function varies depending on the settings of Pr30 (2nd gain setting) and Pr03 (Selection of torque limit).
<table>
<tr><th>Pr30</th><th>Connection to COM–</th><th>Content</th></tr>
<tr><td rowspan="2">0</td><td>Open</td><td>Velocity loop : PI (Proportion/Integration) action</td></tr>
<tr><td>Close</td><td>Velocity loop : P (Proportion) action</td></tr>
<tr><td rowspan="5">1</td><td colspan="2">when the settings of Pr31,Pr36 and 3A are 2</td></tr>
<tr><td>Open</td><td>1st gain selection (Pr10,11,12,13 and 14)</td></tr>
<tr><td>close</td><td>2nd gain selection (Pr18,19,1A,1B and 1C)</td></tr>
<tr><td colspan="2">when the settings of Pr31,Pr36 and 3A are 2</td></tr>
<tr><td colspan="2">invalid</td></tr>
</table></td></tr>
<tr><td>28</td><td>DIV</td><td>Electronic gear (division/multiplication) switching input
• Function varies depending on the control mode.
• Input of internal speed selection 3 (INTSP3)
•You can make up to 8-speed settings combining INH/INTSP1 and CL/INTSP2 inputs.</td></tr>
</table>

9.4 Position mode related inputs

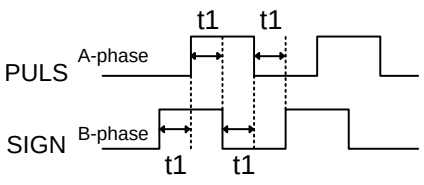
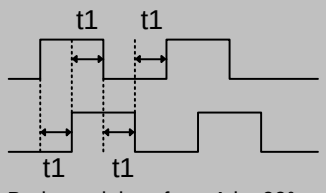
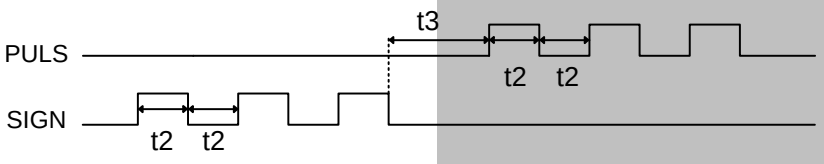
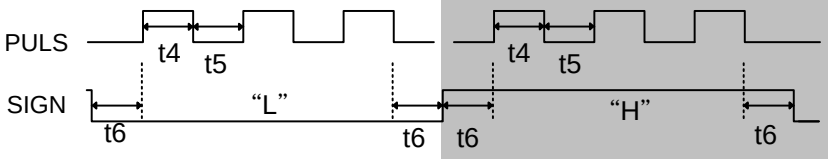
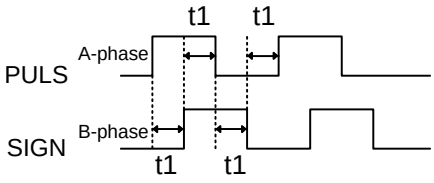
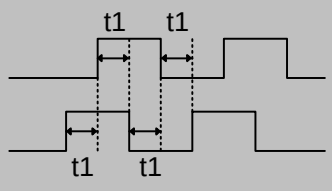
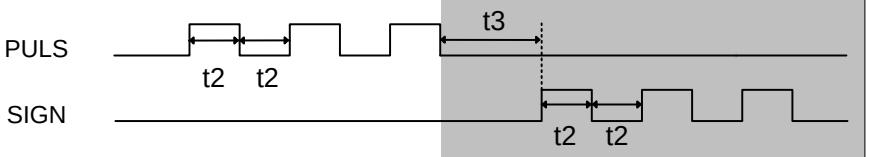
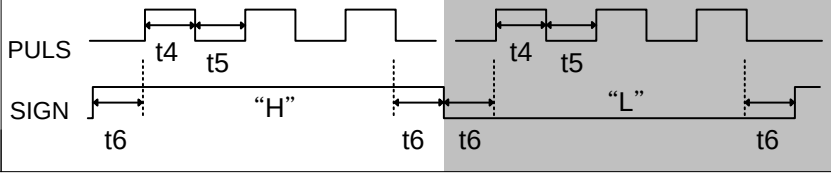
<table>
<tr><th>Signal Type</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td rowspan="2">position</td><td>28</td><td>DIV</td><td>Electronic gear (division/multiplication) switching input
• Function varies depending on the control mode.
• You can switch the numerator of electronic gear. By connecting DIV to COM–, you can switch the numerator of electronic gear from Pr47 (1st numerator of electronic gear) to Pr48 (2nd numerator of electronic gear)
• For the selection of command division/multiplication, refer to the table of next page, "Numerator selection of command scaling"
<Caution>
Do not enter the command pulse 10ms before/after switching.</td></tr>
<tr><td>29</td><td>SV-ON</td><td>Servo on input
• Servo drive energize the servo motor while SV-ON is activated.
• Turns to Servo-ON status by connecting this input to COM–.
• Turns to Servo-OFF status by opening connection to COM–, and current to the motor will be shut off.
• You can select the dynamic brake action and the deviation counter clearing action at Servo-OFF with Pr69 (Sequence at Servo-OFF).
<Caution>
1.Servo-ON input becomes valid approx.2 sec after power-on. (see P.109, "Timing Chart" of Preparation.)
2.Never run/stop the motor with Servo-ON/OFF.
3.After shifting to Servo-ON, allow 100ms or longer pause before entering the pulse command.</td></tr>
</table>

Numerator selection of electronic gear

CN X5 Pin-28 DIV	Setup of electronic gear
Open	$\text{1st numerator of electronic gear (Pr46)} \times 2^{\text{Multiplier of command scaling (Pr4A)}} \Big/ \text{Denominator of electronic gear (Pr4B)}$
Short	$\text{2nd numerator of electronic gear (Pr46)} \times 2^{\text{Multiplier of command scaling (Pr4A)}} \Big/ \text{Denominator of electronic gear (Pr4B)}$

<table>
<tr><td rowspan="2">position</td><td>30</td><td>CLR / INSP2</td><td>Deviation counter clear input
• Function varies depending on the control mode.
• Input (CL) which clears the positional deviation counter and full-closed deviation counter.
• You can clear the counter of positional deviation by connecting this to COM–.
• You can select the clearing mode with Pr4E (Counter clear input mode).
<table>
<tr><th>Pr4D</th><th>Content</th></tr>
<tr><td>0</td><td>Clears the counter of positional deviation while CLR is connected to COM–.</td></tr>
<tr><td>1 [Default]</td><td>Clears the counter of positional deviation only once by connecting CLR to COM– from open status.</td></tr>
<tr><td>2</td><td>CLR is invalid.</td></tr>
</table></td></tr>
<tr><td>31</td><td>ALM-CLR</td><td>Alarm clear input
• You can release the alarm status by connecting this to COM– for more than 120ms.
• The deviation counter will be cleared at alarm clear.
• There are some alarms which cannot be released with this input.</td></tr>
<tr><td>position</td><td>33</td><td>PULS-INH / INSP1</td><td>Inhibition input of command pulse
• Function varies depending on the control mode.
<table>
<tr><td>Position control</td><td>• Inhibition input of command pulse input (INH)
• Ignores the position command pulse by opening the connection to COM–
• You can invalidate this input with Pr43 (Invalidation of command pulse inhibition input)
<table>
<tr><th>Pr43</th><th>Content</th></tr>
<tr><td>0</td><td>INH is valid</td></tr>
<tr><td>1(Default)</td><td>INH is invalid</td></tr>
</table></td></tr>
</table></td></tr>
<tr><td rowspan="9">position</td><td>44</td><td>PLUSH1</td><td rowspan="4">Command pulse sign input #1
• If Pr40 = 1; command pulse input #1 will be enabled.
• Permissible max. input frequency is 2Mpps.
• You can select up to 6 command pulse input formats with Pr41 (Setting of command pulse rotational direction) and Pr42 (Setting of command pulse input mode).For details, refer to the table below, "Command pulse input format".
refer 6.3 Line driver pulse command input</td></tr>
<tr><td>45</td><td>PLUSH2</td></tr>
<tr><td>46</td><td>SIGNH1</td></tr>
<tr><td>47</td><td>SIGNH2</td></tr>
<tr><td>1</td><td>OPC1</td><td rowspan="5">Command pulse sign input #2
• If Pr40 = 0; command pulse input #2 will be enabled.
• Permissible max. input frequency is 500kpps at line driver input and 200kpps at open collector input.
• You can select up to 6 command pulse input formats with Pr41 (Setting of command pulse rotational direction) and Pr42 (Setting of command pulse input mode). For details, refer to the table below, "Command pulse input format".
refer 6.2 Pulse command input circuit (photo-coupled)</td></tr>
<tr><td>3</td><td>PULS1</td></tr>
<tr><td>4</td><td>PULS2</td></tr>
<tr><td>2</td><td>OPC2</td></tr>
<tr><td>5</td><td>SIGN1</td></tr>
<tr><td>6</td><td>SIGN2</td></tr>
</table>

9.5 Command pulse input format

Pr41 setup value	Pr42 setup value	CCW command	CW command
【0】	0 or 2	 B-phase advances to A by 90°.	 B-phase delays from A by 90°.
	【1】		
	3		
【1】	0 or 2	 B-phase delays from A by 90°.	 B-phase advances to A by 90°.
	【1】		
	3		

•PULS and SIGN represents the pulse train to input circuit.

•Pulse train will be captured at the rising edge for CW/ CCW or pulse /direction input mode.

•In case of 2-phase input (A phase and B phase), pulse train will be captured at both edge.

•Permissible max. input frequency of command pulse input signal and min. necessary time width

Input I/F of PULS/SIGN signal		Permissible max. input frequency	Min. necessary time width					
			t1	t2	t3	t4	t5	t6
Pulse train interface exclusive to line driver		2Mpps	500ns	250ns	250ns	250ns	250ns	250ns
Pulse train interface	Line driver interface	500kpps	2µs	1µs	1µs	1µs	1µs	1µs
	Open collector interface	200kpps	5µs	2.5µs	2.5µs	2.5µs	2.5µs	2.5µs

Make the rising/falling time of the command pulse input signal to 0.1µs or smaller.

10. Analog input signals and their functions

<table>
<tr><th>Type</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td rowspan="4">speed/
torque</td><td rowspan="4">14</td><td rowspan="4">SPR /
TRQR</td><td>Speed command input or Torque command input
• Function varies depending on control mode.
<table>
<tr><th>Pr02</th><th>Control mode</th><th>function</th></tr>
<tr><td>3</td><td>Position/
Velocity</td><td>• Input of external speed command (SPR) when the velocity control is selected.
• Set up the gain, polarity, offset and filter of the Speed command with:
Pr50 (Speed command input gain)
Pr51 (Speed command input reversal)
Pr52 (Speed command offset)</td></tr>
<tr><td>4</td><td>Position/
Torque</td><td>• Function varies depending on Pr5B (Selection of torque command)
<table>
<tr><th>Pr5b</th><th>Content</th></tr>
<tr><td>0</td><td>• Torque command (TRQR) will be selected.
• Set up the torque (TRQR) gain, polarity,
Offset with:
Pr5C (Torque command input gain)
Pr5D (Torque command input reversal)
Pr52 (Speed command offset)</td></tr>
<tr><td>1</td><td>• Speed limit (SPL) will be selected.
• Set up the speed limit (SPL) gain, offset and filter with:
Pr50 (Speed command input gain)
Pr52 (Speed common offset)</td></tr>
</table></td></tr>
<tr><td>Others</td><td>Other control mode</td><td>•This input is invalid</td></tr>
</table>
•The resolution of the A/D converter used in this input is 12 bit (including 1 bit for sign). ±2047 = ±10[V]</td></tr>
</table>

<table>
<tr>
<td>position/
velocity/
torque</td>
<td>16</td>
<td>CCWTL /
TRQR</td>
<td>CCW-Torque limit input
• Function varies depending on Pr02 (Control mode setting).
<table>
<tr><th>Pr02</th><th>Control mode</th><th>content</th></tr>
<tr><td>2
4</td><td>Torque control
Position/Torque</td><td>• Function varies depending on Pr5B (Selection of torque command)
<table>
<tr><th>Pr5B</th><th>Content</th></tr>
<tr><td>0</td><td>This input becomes invalid.</td></tr>
<tr><td>1</td><td>• Torque command input (TRQR) will be selected.
• Set up the gain, polarity and offset of the command with:
Pr5C (Torque command input gain)
Pr5D(Torque command input reversal)
Pr2A (CCW Torque Control Offset)</td></tr>
</table></td></tr>
<tr><td>5</td><td>Velocity/Torque</td><td>• Becomes to the torque command input (TRQR).
• Set up the gain, polarity and offset of the command with:
Pr5C (Torque command input gain)
Pr5D(Torque command input reversal)
Pr2A (CCW Torque Control Offset)</td></tr>
<tr><td>4
5
other</td><td>Position/Torque
Velocity/Torque
Other control mode</td><td>• Becomes to the analog torque limit input to CCW(CCWTL).
• Limit the CCW-torque by applying positive voltage(0 to +10V) (Approx.+3V/rated toque)
• Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.</td></tr>
</table>
•The resolution of the A/D converter used in this input is 12 bit (including 1 bit for sign). ±2047= ±10[V]</td>
</tr>
</table>

<table>
<tr>
<td>position/
velocity/
torque</td>
<td>18</td>
<td>CWTL</td>
<td>CW-Torque limit input
• Function varies depending on Pr02 (Control mode setting).
<table>
<tr><th>Pr02</th><th>Control mode</th><th>Content</th></tr>
<tr><td>2
4
5</td><td>Torque control
Position/Torque
Velocity/Torque</td><td>•This input becomes invalid when the torque control is selected.</td></tr>
<tr><td>4
5
other</td><td>Position/Torque
Velocity/Torque
Other control mode</td><td>• Becomes to the analog torque limit input to CW(CWTL).
• Limit the CW-torque by applying negative voltage (0 to –10V) (Approx.+3V/rated toque).
Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.</td></tr>
</table>
•The resolution of the A/D converter used in this input is 12 bit (including 1 bit for sign). ±2047= ±10[V]</td>
</tr>
</table>

Note:
Do not apply voltage exceeding ±10V to analog command input of SPR/TRQR.

11. Output Signals and Their Functions

11.1 Common output signals

<table>
<tr><th>Type</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td rowspan="2">position/
velocity/
torque</td><td>11</td><td>BK-OFF+</td><td rowspan="2">External brake release signal
• Feeds out the timing signal which activates the electromagnetic brake of the motor.
•Turns the output transistor ON at the release timing of the electromagnetic brake.
• You can set up the output timing of this signal with
Pr6A (Setting of mechanical brake action at stall)
Pr6B (Setting of mechanical brake action at motion).
For details, refer to Chapter 14 Control Sequence Timing Chart)</td></tr>
<tr><td>10</td><td>BK-OFF-</td></tr>
<tr><td rowspan="6">position/
velocity/
torque</td><td>35</td><td>SVO-RDY+</td><td rowspan="2">Servo-Ready output
• This signal shows that the driver is ready to be activated.
• Output transistor turns ON when both control and main power are ON but not at alarm status.</td></tr>
<tr><td>34</td><td>SVO-RDY-</td></tr>
<tr><td>37</td><td>SVO-ALM+</td><td rowspan="2">Servo-Alarm output
• This signal shows that the driver is in alarm status.
• Output transistor turns ON when the driver is at normal status, turns OFF at alarm status.</td></tr>
<tr><td>36</td><td>SVO-ALM-</td></tr>
<tr><td>39</td><td>IN-POS+</td><td rowspan="2">Positioning complete (In-position)
• Function varies depending on the control mode.
<table><tr><td>Position control</td><td>Output of positioning complete (IN-POS)
• The output transistor will turn ON when the absolute value of the position deviation pulse becomes smaller than the setting value of Pr60 (Positioning complete range).</td></tr><tr><td>Velocity /Torque control</td><td>Output in-speed (speed arrival) (IN-SPEED)
• The output transistor will turn ON when the actual motor speed exceeds the setting value of Pr62 (In-speed).</td></tr></table></td></tr>
<tr><td>38</td><td>IN-POS-</td></tr>
<tr><td>12
(41)</td><td>ZSP
(COM-)</td><td>Zero-speed detection output signal
• Content of the output signal varies depending on Pr0A (Selection of ZSP output).
• Default is 1, and feeds out the zero speed detection signal.
• For details, see the table below, "Selection of TLC,ZSP output".</td></tr>
<tr><td></td><td>40
(41)</td><td>TLC
(COM-)</td><td>Torque in-limit signal output
• Content of the output signal varies depending on Pr09 (Selection of TLC output).
• Default is 0, and feeds out the torque in-limit signal.
• For details, see the table below, "Selection of TLC,ZSP output".</td></tr>
</table>

Selection of TCL and ZSP outputs

Value of Pr09 or Pr0A	I/F TLC : Output of Pin-40	I/F ZSP : Output of Pin-12
0	Torque in-limit output (Default of I/F TLC Pr09) • The output transistor turns ON when the torque command is limited by the torque limit during Servo-ON.	
1	Zero-speed detection output (Default of I/F ZSP Pr0A) • The output transistor turns ON when the motor speed falls under the preset value with Pr61.	
2	Alarm signal output • The output transistor turns ON when either one of the alarms is triggered, over-regeneration alarm, overload alarm.	
3	Over-regeneration alarm • The output transistor turns ON when the regeneration exceeds 85% of the alarm trigger level of the regenerative load protection.	
4	Over-load alarm • The output transistor turns ON when the load exceeds 85% of the alarm trigger level of the overload alarm.	

11.2 Encoder signal outputs

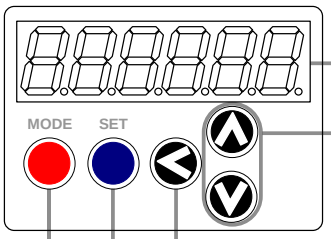
<table>
<tr><th>Type</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td rowspan="8">position/
velocity/
torque</td><td>21</td><td>OA+</td><td rowspan="7">OA+,OA-: A phase output
OB+,OB-: B-phase output
OZ+,OZ-: Z-phase output

• You can set up the division ratio with
Pr44 (Output Pulse Pre-division of Every Reversion)
Pr4E(Numerator of pulse output division) and
Pr4F(Denominator of pulse output division)
• You can select the logic relation between A-phase and B-phase, and the output source with Pr45 (Reversal of pulse output logic).
• Ground for line driver output is connected to signal ground (GND) and is not insolated.
• Max. output frequency is 4Mpps (after multiplied by 4)</td></tr>
<tr><td>22</td><td>OA-</td></tr>
<tr><td>48</td><td>OB+</td></tr>
<tr><td>49</td><td>OB-</td></tr>
<tr><td>23</td><td>OZ+</td></tr>
<tr><td>24</td><td>OZ-</td></tr>
<tr><td>19</td><td>CZ</td><td>Z-phase output
• Open collector output of Z-phase signal
• The emitter side of the transistor of the output is connected to the signal ground (GND) and is not insolated.</td></tr>
<tr><td></td><td>42</td><td>IM</td><td>Torque monitor signal output
• The content of output signal varies depending on Pr08 (Torque monitor(IM) selection).
• You can set up the scaling with Pr08 value.
<table>
<tr><th>Pr08</th><th>Content of signal</th><th>Function</th></tr>
<tr><td>0-2</td><td>Torque command</td><td>• Feeds out the voltage in proportion to the motor torque command with polarity.
+ : generates CCW torque
– : generates CW torque</td></tr>
<tr><td>3-7</td><td>Position deviation</td><td>• Feeds out the voltage in proportion to the position deviation pulse counts with polarity.
+ : CCW command to motor
– : CW command to motor</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>43</td><td>SPM</td><td>Speed monitor signal output
• The content of the output signal varies depending on Pr07 (Speed monitor (IM) selection).
• You can set up the scaling with Pr07 value.
<table>
<tr><th>Pr07</th><th>Control mode</th><th>Function</th></tr>
<tr><td>0-4</td><td>Motor speed</td><td>• Feeds out the voltage in proportion to the motor speed with polarity.
+ : rotates to CCW
– : rotates to CW</td></tr>
<tr><td>5-9</td><td>Command speed</td><td>• Feeds out the voltage in proportion to the command speed with polarity.
+ : rotates to CCW
– : rotates to CW</td></tr>
</table></td></tr>
<tr><td></td><td>13,15,
17,25</td><td>GND</td><td>Signal ground
• This output is insulated from the control signal power (COM–) inside of the driver.</td></tr>
<tr><td></td><td>50</td><td>FG</td><td>Frame ground
• This output is connected to the earth terminal inside of the driver.</td></tr>
</table>

12. Setting with the Front Panel

12.1 Composition of Touch Panel and Display



Display LED (6-digit)
All of LED will flash when error occurs,
and switch to error display screen.
All of LED will flash slowly when warning occurs.

Press these to change display and data, select parameters and execute actions.
(Change/Selection/Execution is valid to the digit which decimal point flashes.)
Numerical value increases by pressing ▲,
decreases by pressing ▼.

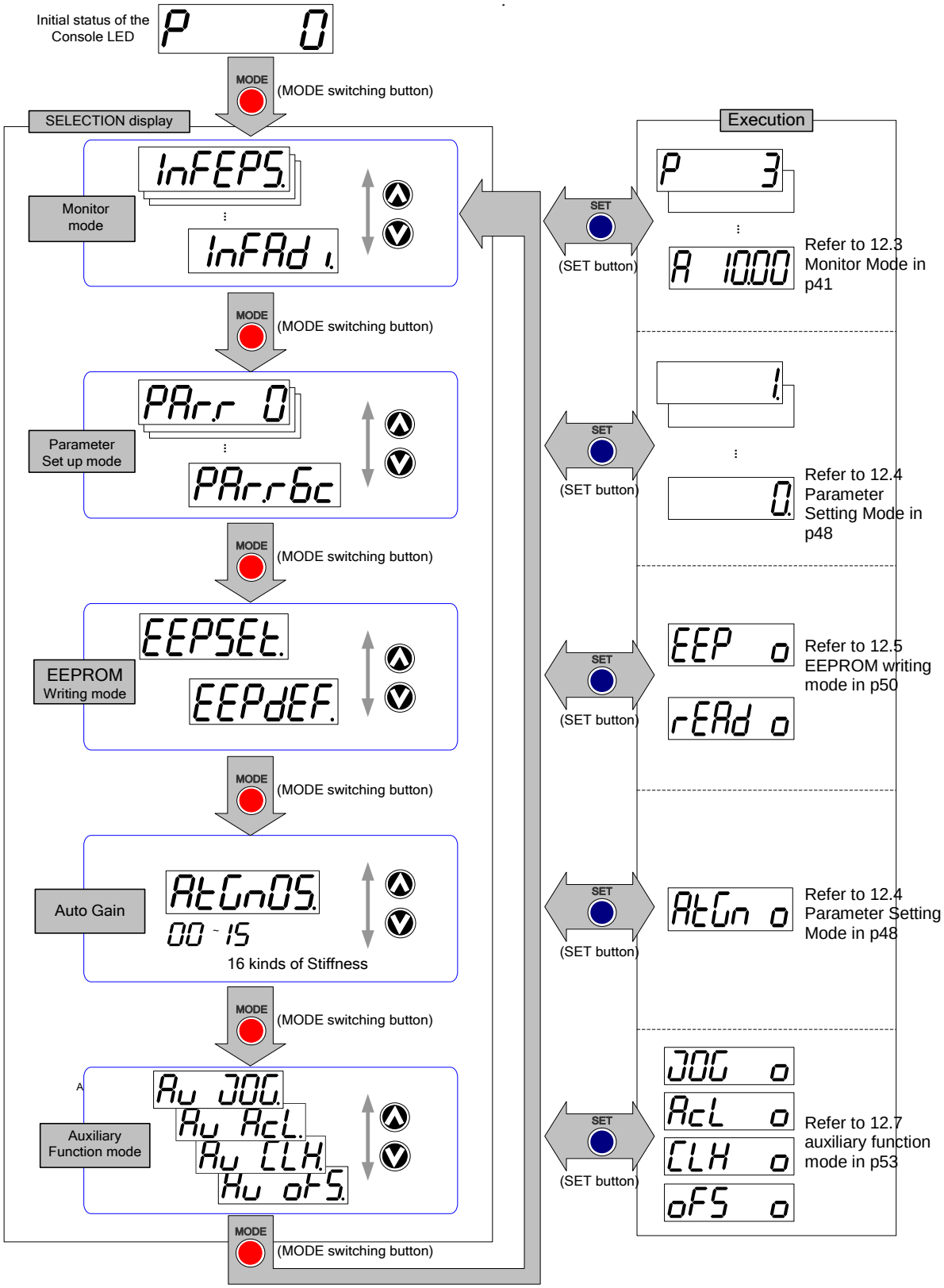
◀ Shifting of the digit for data changing to higher digit.
(Valid to the digit whose decimal point flashes.)

SET Button (valid at any time)
Press this to switch SELECTION and EXECUTTION display.

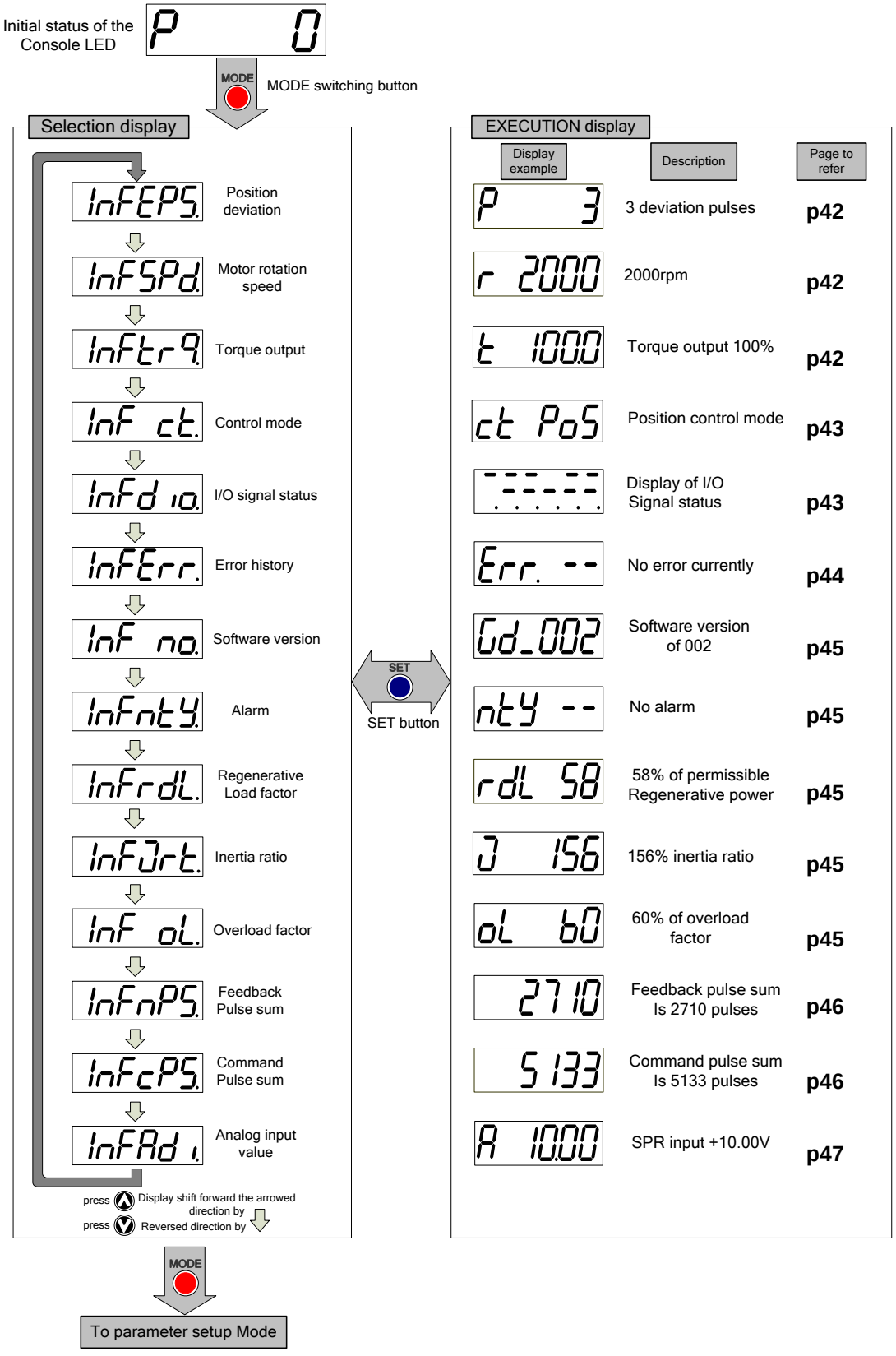
Mode switching button (valid at SELECTION display)
Press this to switch 5 kinds of mode.

1) Monitor Mode
2) Parameter Set up Mode
3) EEPROM Write Mode
4) Auto-Gain Tuning Mode
5) Auxiliary Function Mode

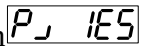
12.2 Structure of Each Mode


Initial status of the Console LED
MODE
(MODE switching button)
SELECTION display
Execution
Monitor mode
Parameter Set up mode
EEPROM Writing mode
Auto Gain
16 kinds of Stiffness
Auxiliary Function mode
SET
(SET button)
Refer to 12.3 Monitor Mode in p41
Refer to 12.4 Parameter Setting Mode in p48
Refer to 12.5 EEPROM writing mode in p50
Refer to 12.4 Parameter Setting Mode in p48
Refer to 12.7 auxiliary function mode in p53

12.3 Monitor Mode


Initial status of the Console LED
P 0
MODE
MODE switching button
Selection display
InFEPS. Position deviation
InFSPd. Motor rotation speed
InFtr9. Torque output
InF ct. Control mode
InFd io. I/O signal status
InFErr. Error history
InF no. Software version
InFnty. Alarm
InFrdL. Regenerative Load factor
InFJrt. Inertia ratio
InF oL. Overload factor
InFnPS. Feedback Pulse sum
InFcPS. Command Pulse sum
InFAd1. Analog input value
press Display shift forward the arrowed direction by
press Reversed direction by
SET
SET button
EXECUTION display
Display example
Description
Page to refer
P 3 3 deviation pulses p42
r 2000 2000rpm p42
t 100.0 Torque output 100% p42
ct PoS Position control mode p43
Display of I/O Signal status p43
Err. -- No error currently p44
Cd_002 Software version of 002 p45
nty -- No alarm p45
rdL 58 58% of permissible Regenerative power p45
J 156 156% inertia ratio p45
oL 60 60% of overload factor p45
2710 Feedback pulse sum Is 2710 pulses p46
5133 Command pulse sum Is 5133 pulses p46
A 10.00 SPR input +10.00V p47
MODE
To parameter setup Mode

12.3.1 Display of position deviation

Purpose: display position deviation (cumulative pulse counts of deviation counter)
"–" + number display: generates rotational torque of CW direction (viewed from shaft end)
only number display : generates rotational torque of CCW direction (viewed from shaft end)
Display Scope：–9999 ~ 9999 （value less than low limit is displayed with ,value over upper limit is displayed with  ）
Unit：Pulse

12.3.2 Rotary Speed of Motor

Purpose: display motor speed in rpm
"–" + number display : CW rotation
only number display: CCW rotation
Unit：rpm

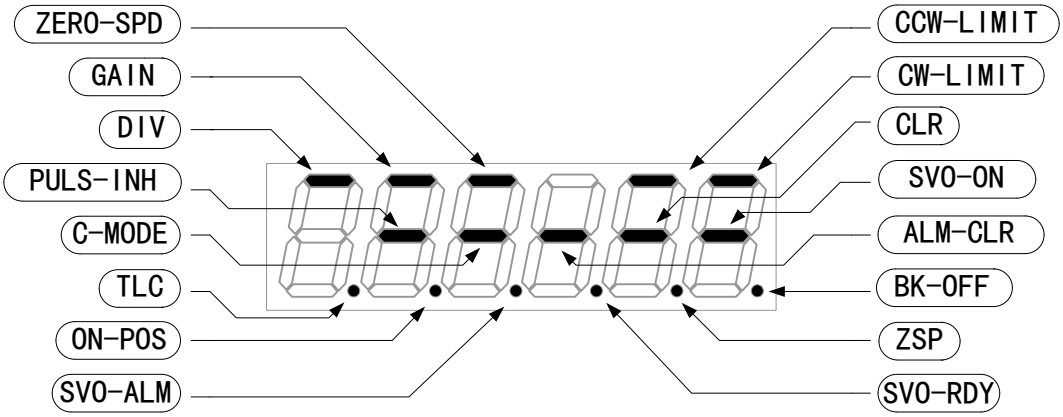
12.3.3 Torque output

Purpose: display torque output in percentage of rated torque
"–" + number display : CW rotation
only number display : CCW rotation
Scope：–300 ~ 300 (100% in rated torque)
Unite：%

12.3.4 Display of control mode

Panel Display		Setting Value of Pr02
State of C-MODE pins（32Pin）of I/F joint		
Open	Short	
ct PoS	ct PoS	0 Position control mode
ct SPd	ct SPd	1 Velocity control mode
ct tr9	ct tr9	2 Torque control mode
ct PoS	ct SPd	3 Position/Velocity control mode
ct PoS	ct tr9	4 Position/Torque control mode
ct SPd	ct tr9	5 Velocity/Torque control mode

12.3.5 Display of I/O signal status



Purpose: display the state of input/output signal connecting to I/F

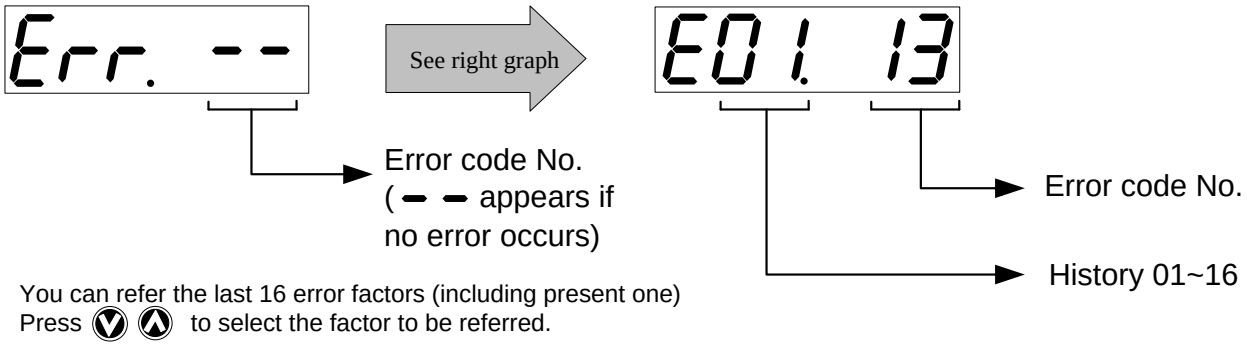
The segment of LED lights, it means that the signal input switch is on else input switch is off.

* About the names and functions of all output signals, refer to the connection of all control modes.

* It's switch connecting CCW-LIMIT and CW-LIMIT, use B connection of usually closed switch.

* It's can be used to test whether the wiring is correct or not.

12.3.6 Error code Display



You can refer the last 16 error factors (including present one)
Press ▼ ▲ to select the factor to be referred.

Purpose: display error code and its history

Error code No. and its meaning

Error Code No.	Meaning	Error Code No.	Meaning
--	No fault	24	Excess position deviation protection
11	Under-voltage protection for control power	26	Over-speed protection
12	Over-voltage protection	29	Deviation counter overflow protection
13	Under-voltage protection for main power	36	EEPROM parameter error protection
14	Over-current protection(software)	37	EEPROM parameter error protection
15	Overheat protection	38	Run-inhibit input protection
16	Overload protection	48	Encoder Z-phase error protection
18	Over-regenerative load protection	49	Encoder Z phase lose protection
20	Encoder A,B phase error protection	50	Encoder Z phase double signal.
21	Encoder communication error protection	99	Over-current protection(Hardware)
22	Encoder communication data error protection		

※Following errors are not included in the history Error Code No.11、13

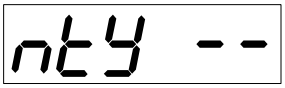
Protective Function (Detail of Error Code)

Error Code No.	Meaning	Causes
11	Under-voltage protection for control power	While DSP is low voltage, inhibit process of EEPROM and display error.
12	Over-voltage protection	Occurs while voltage is over AC 260V.
13	Under-voltage protection for main power	Occurs while voltage is lower than AC 170V or connection of single phase power is not correct.
18	Over-regenerative load protection	Occurs while DC-bus is over DC400V(AV283V), flyback rate is 100%, the bench-mark of flyback limit is DC 368V, 0%, and DC 395V, 85%.
20,21 22,48	Encoder communication error protection Encoder Z-phase error protection Encoder communication data error protection	Verify whether connector of SIG encoder correctly connect to driver. Verify connection of male and female connector of encoder cable is correct.
14,99 99	Over-current protection(software) Over-current protection(Hardware)	Verify whether motor power(U,V,W) is short circuit or loose.

12.3.7 Display of Software Version

Purpose: display the software version of driver.

12.3.8 Alarm Display



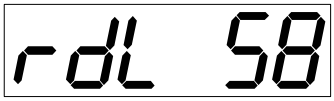
-……no alarm、A ……Alarm occurrence

Over-regeneration alarm：Turns on when regenerative load reaches more than 85% of alarm trigger level of regenerative load protection.

Overload alarm：Turns on when the load reaches 85% or more of alarm trigger level of over-load protection.

Over 85%, the LED panel will keep on flickering.

12.3.9 Display of Regenerative Load Factor



Display the ratio (%) against the alarm trigger level of regenerative protection.
This is valid when Pr6C (Selection of external regenerative resistor) is 0 or 1.

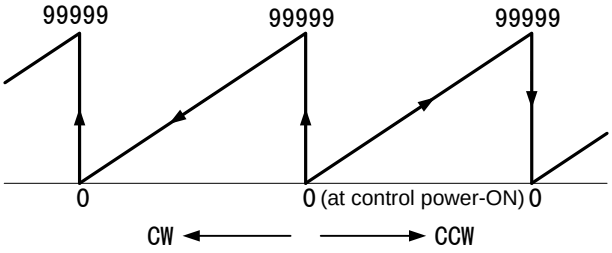
12.3.10Display of Over-load Factor

Displays the ratio (%) against the rated load. Refer to Charpter 6, "Overload Protection Time Characteristics" of When in Trouble.

12.3.11Display of feedback pulse sum, command pulse sum

Scope：0～99999
Unit：Pules

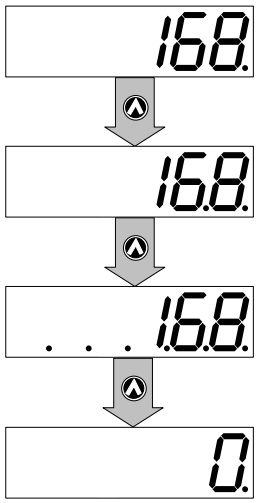
Total sum of pulses after control power-on display overflows as the figures show.



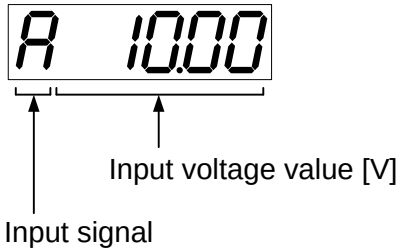
By pressing for approx. 3 sec. or longer on either one of screens of total sum of pulses display, you can clear feedback total sum, command pulse total sum or external scale feedback pulse total sum to “ 0 ” .

[0-clear EXECUTION display]

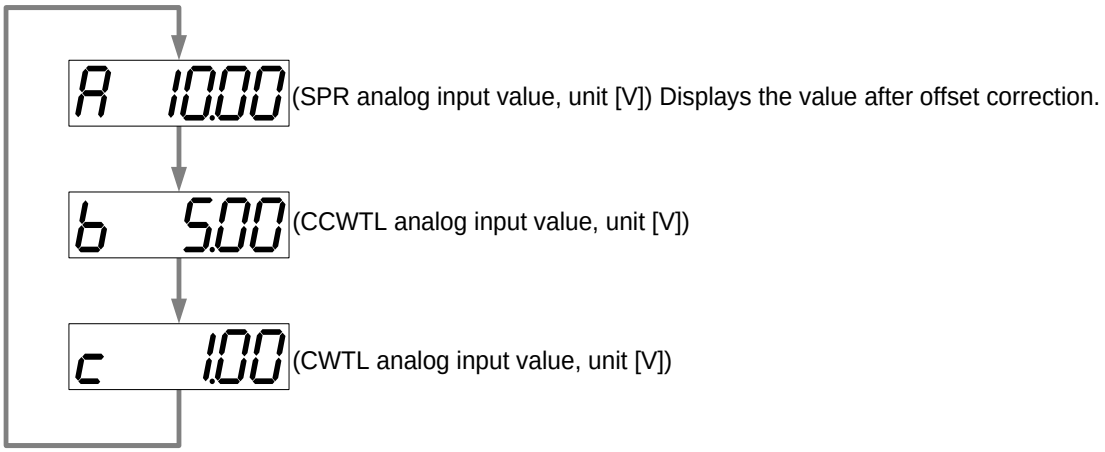
Keep pressing ⓐ to shift the “•” as the right fig. shows.



12.3.12Display of analog input value



There are 3 analog inputs: SPR, CCWTL and CWTL; select the signal to be monitored by pressings ▲▼ .

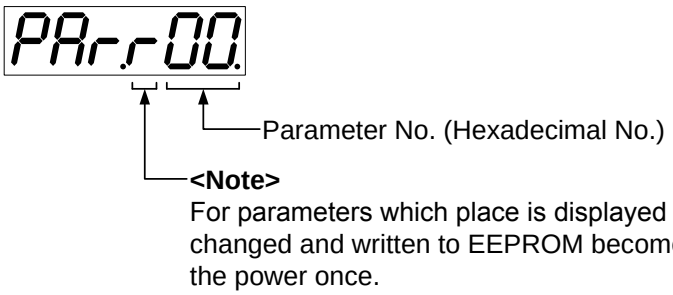

A 10.00
(SPR analog input value, unit [V]) Displays the value after offset correction.
b 5.00
(CCWTL analog input value, unit [V])
c 1.00
(CWTL analog input value, unit [V])

Note) Voltage exceeding ± 10V can not be displayed correctly.

12.4 Parameter Setting Mode

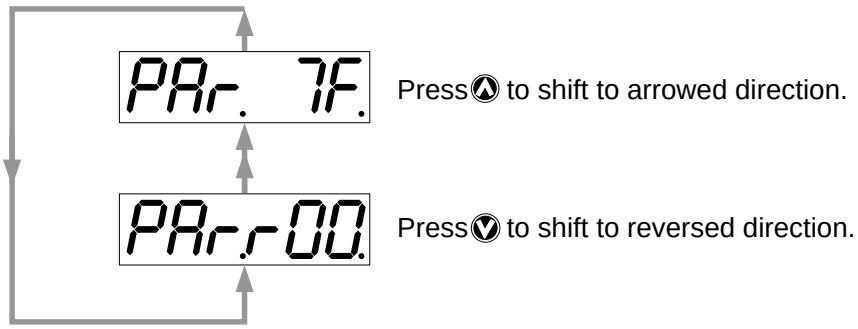
12.4.1 How to enter the parameter setting mode

From the initial state of LED, press MODE twice to enter the parameter setting mode – parameter number selection.

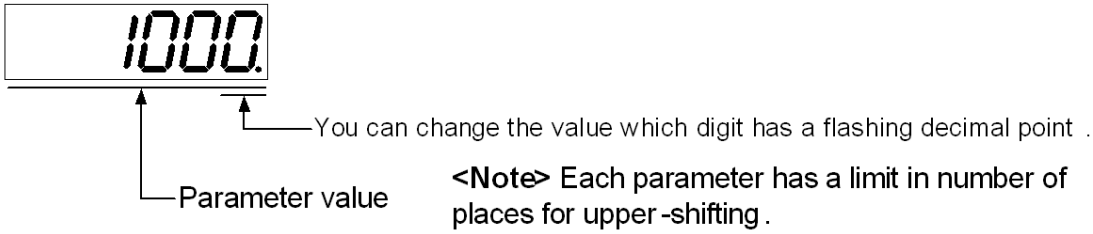


<Note>
For parameters which place is displayed with "r", the content changed and written to EEPROM becomes valid after turning off the power once.

Press ▲ or ▼ to select parameter No. to be referred/set.



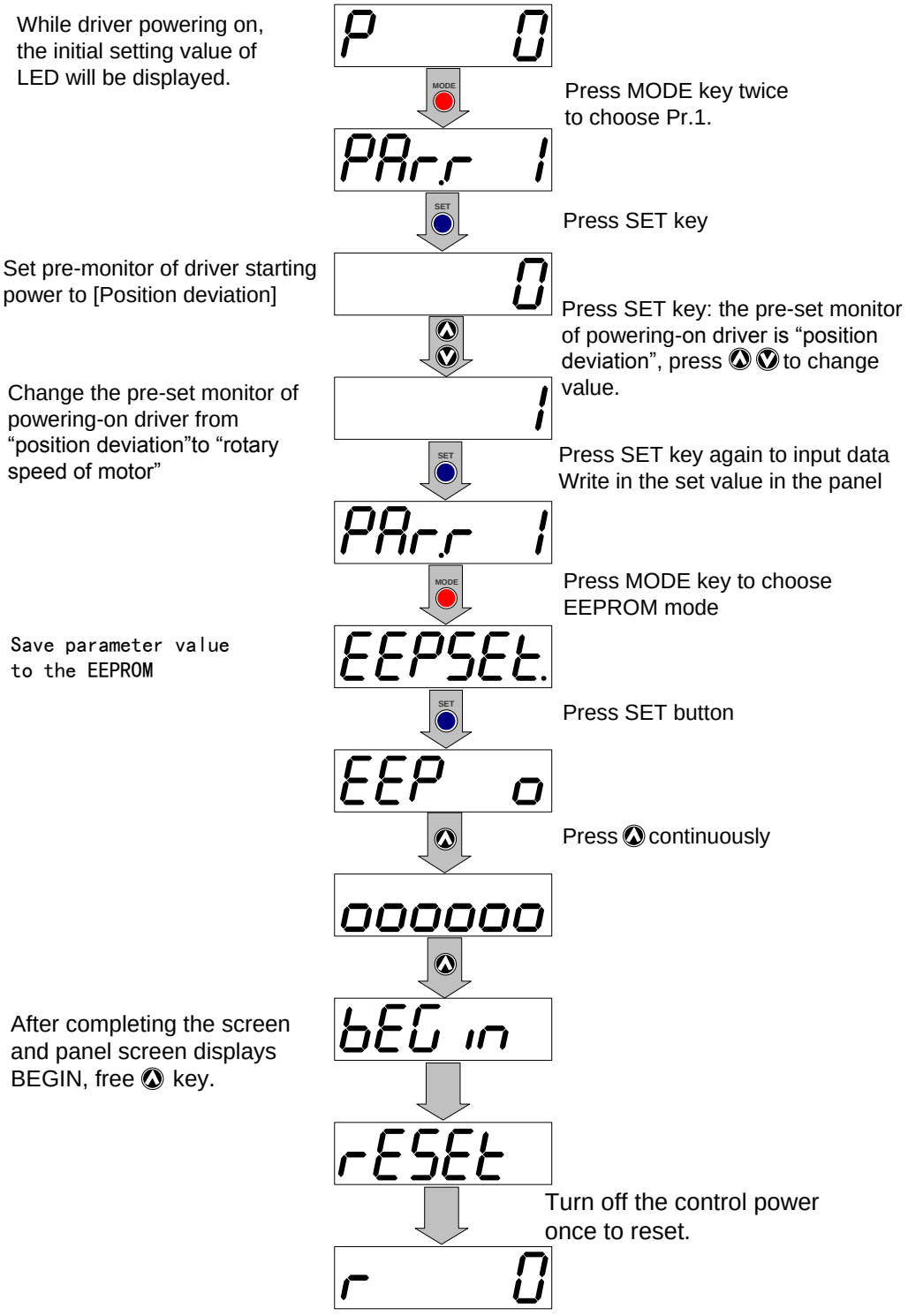
After selecting the parameter number you want to set, Press SET to enter the parameter data entry mode.


1000.
You can change the value which digit has a flashing decimal point .
Parameter value
<Note> Each parameter has a limit in number of places for upper-shifting .

You can change the decimal point with ◀ to select the digit to be change.
Press ▼ or ▲ to set up the value of the digit.

Note: After changing the parameter value and pressing SET , the content will be reflected in the control. For some parameters such as that concerning velocity loop or position loop, do not extremely change the parameter value which might affect the motor movement very much.

12.4.2 Writing parameter data to EEPROM


While driver powering on, the initial setting value of LED will be displayed.
P 0
MODE
Press MODE key twice to choose Pr.1.
PAr.r 1
SET
Press SET key
Set pre-monitor of driver starting power to [Position deviation]
0
Press SET key: the pre-set monitor of powering-on driver is “position deviation”, press ▲ ▼ to change value.
Change the pre-set monitor of powering-on driver from “position deviation”to “rotary speed of motor”
1
SET
Press SET key again to input data Write in the set value in the panel
PAr.r 1
MODE
Press MODE key to choose EEPROM mode
Save parameter value to the EEPROM
EEPSEt.
SET
Press SET button
EEP 0
Press ▲ continuously
oooooo
After completing the screen and panel screen displays BEGIN, free ▲ key.
bEG in
rESEt
Turn off the control power once to reset.
r 0

The screen will display r0, which means the completion of setting.

• When you change the parameters which contents become valid after resetting, rESEt will be displayed after finish writing. Turn off the control power once to reset.

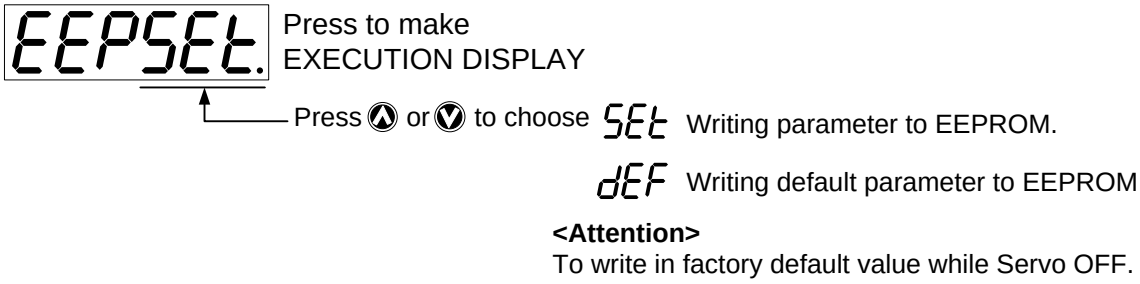
Note 1. When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.

2. Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.

12.5 EEPROM writing mode

12.5.1 How to enter the parameter setting mode

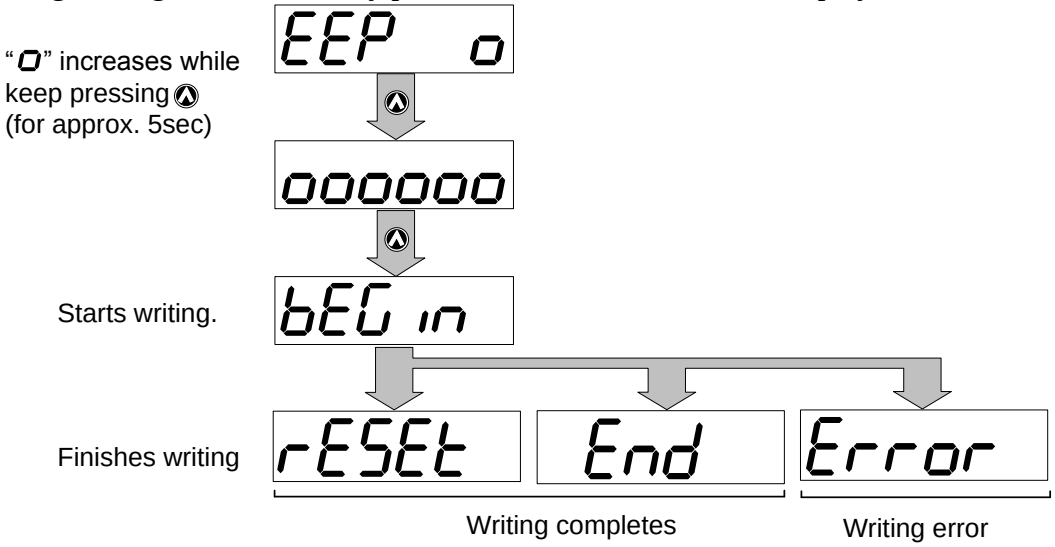
Starting from the initial LED status, press MODE then brings the display of EEPROM writing Mode



<Attention>
To write in factory default value while Servo OFF.

12.5.2 Writing parameter to EEPROM

Under option screen of EEPSEt., press SET to choose EEP o to execution screen.
While executing writing-in, continuously press ▲ until bEG in is displayed.



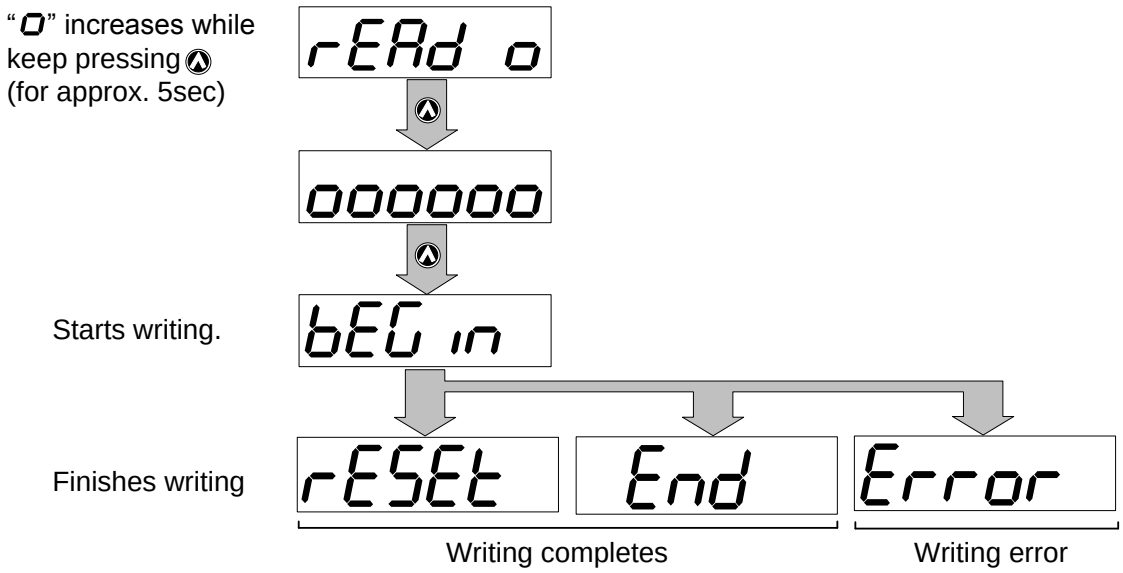
• When you change the parameters which contents become valid after resetting, rESEt will be displayed after finishing wiring. Turn off the control power once to reset.

Note: 1. When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.

2. Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.

12.5.3 Writing factory default value to EEPROM

Under option screen of EEPdEF, press SET to choose rEAd o execution screen. While executing writing-in, continuously press ▲ until bEG in is displayed.



When you change the parameters which contents become valid after resetting, rESEt will be displayed after finishing wiring. Turn off the control power once to reset.

Note: 1. When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.

2. Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.

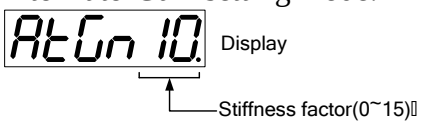
12.6 AUTO-GAIN mode (off-line)

Note:

1. about in- line auto-gain , pleas reference chapter 15 Gain adjustment and speed limit.
2. The motor will be driven in a preset pattern by the driver in off-line auto-gain tuning mode. You can change this pattern with Pr25 (Setting of action at off-line auto-gain tuning), however, shift the load to where the operation in this pattern may not cause any trouble before executing this tuning.
3. Depending on the load, oscillation may occur after the tuning. In order to secure the safety, use Pr14 to eliminate the noise.

12.6.1 How to enter the AUTO-GAIN mode

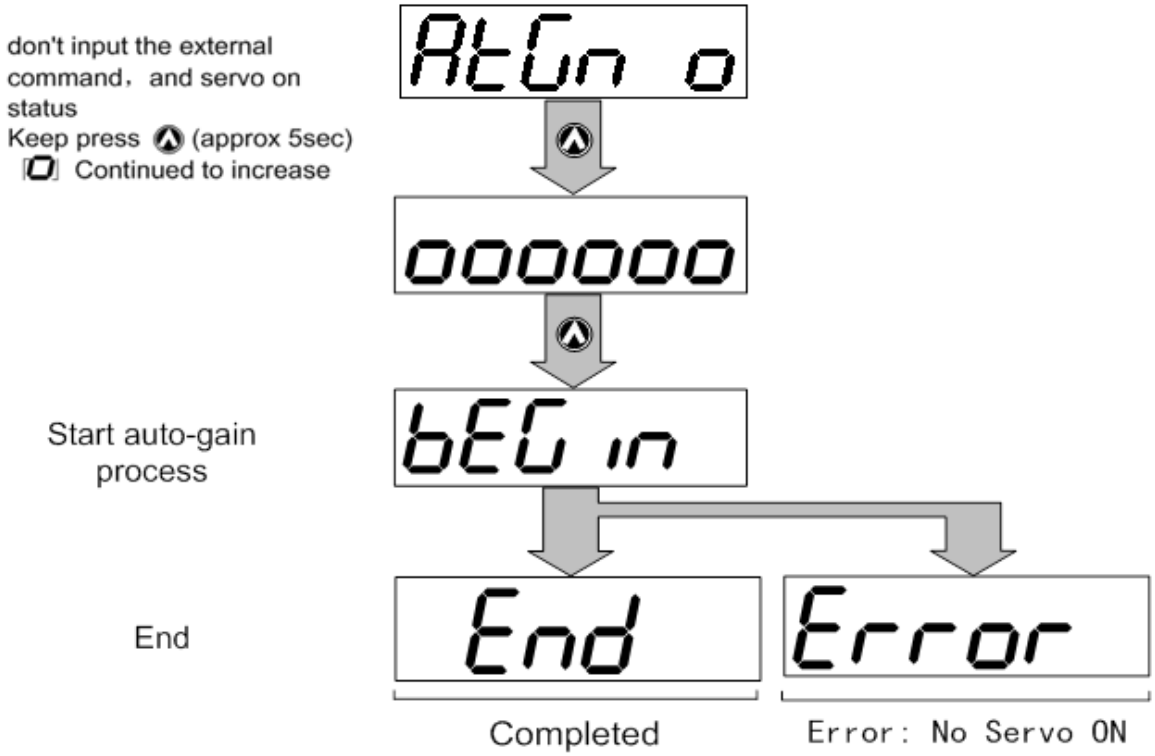
Press MODE four times to enter into Auto-Gain setting mode.



Now press ▲ or ▼ to set mechanical stiffness factor (1~15).

12.6.2 Execute the AUTO-GAIN tuning

Press SET to display AtGn 0 execution screen。



Note:

1. To avoid loss of gain parameter during power off, please store parameter to the EEPROM.
2. When adjustment is wrong, please adjust the gain parameter back to the previous data. Moreover, as load difference; sometimes machine will produce vibration but not faults, so pay attention to the safety.
3. Error occurred, checking the motor Servo ON state.

12.7 auxiliary function mode

You can make a trial run (JOG run) without connecting the Connector, I/F to the host controller such as PLC.

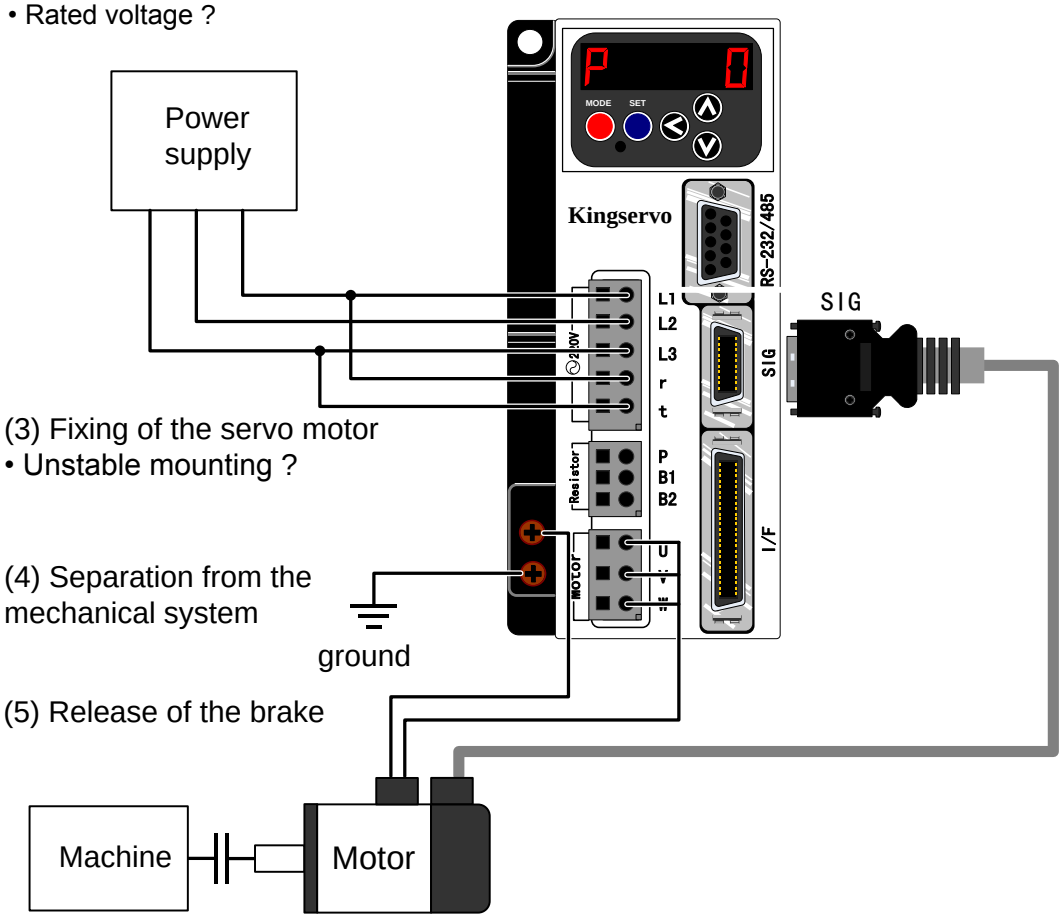
Note:

1. Separate the motor from the load, detach the Connector, CN X5 before the trial run.
2. Bring the user parameter settings (especially Pr11-14 and 20) to defaults, to avoid oscillation or other failure.

12.7.1 Inspection Before Trial Run

(1) Inspection on wiring
• Miswiring ?
(Especially power input and motor output)
• Short or grounded ?
• Loose connection ?

(2) Confirmation of power supply and voltage
• Rated voltage ?



(3) Fixing of the servo motor
• Unstable mounting ?

(4) Separation from the mechanical system

(5) Release of the brake

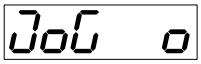
(6) Turn to Servo-OFF after finishing the trial run by pressing SET.

12.7.2 How to enter the trial run (JOG run) mode

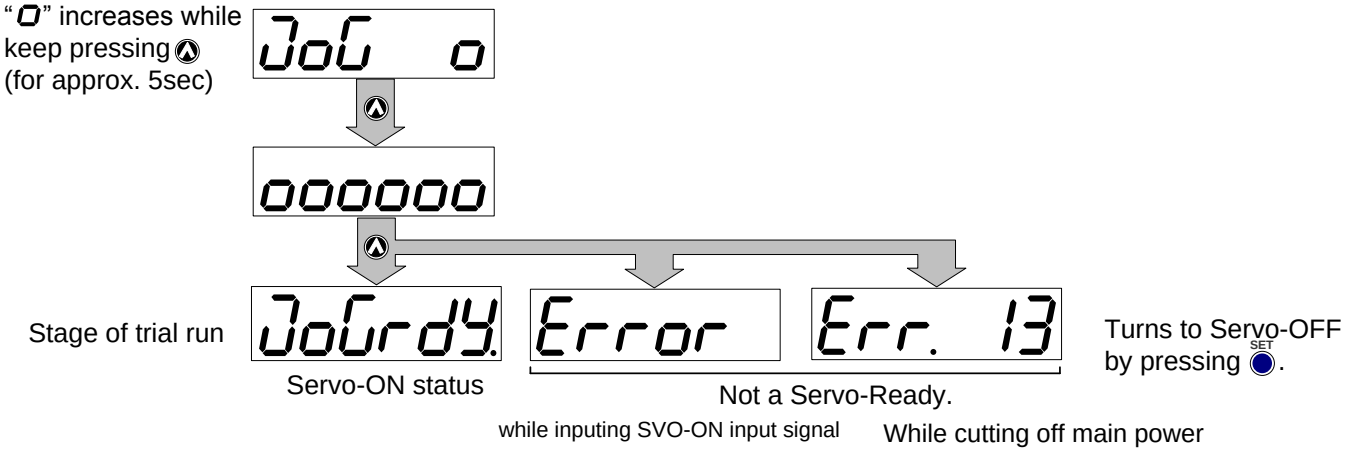
From the initial state of LED, press MODE five times to enter into auxiliary function mode.

Press ▲▼,to display

12.7.3 Execute trial run (JOG run)

Press SET to display 

execution screen.

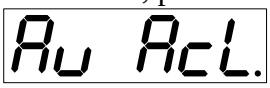


Press▲, motor rotates along CCW; press▼, motor rotates along CW.
Rotate motor with the speed set according to Pr57(JOG speed) (p86).

Free ▲▼, and the motor will cease at once.
After testing run, refer to the structure of all modes in P32 and return to option screen.

12.8 Alarm clear mode

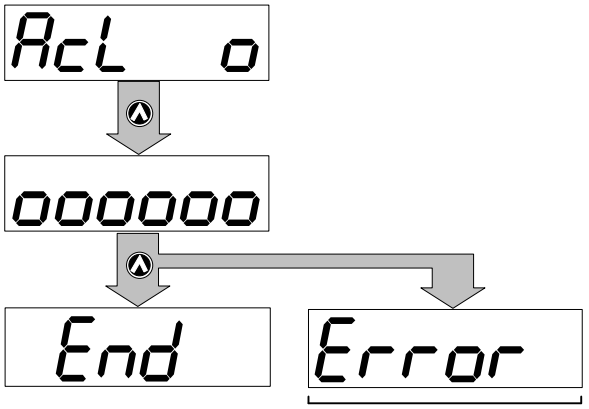
12.8.1 How to enter the alarm clear mode

From the initial state of LED, press MODE five times to enter into auxiliary function mode. Press ▲▼ to display 

12.8.2 Execute alarm clear

Press SET to display AcL o

"0" increases while keep pressing ▲ (for approx. 5sec)



Alarm clear completes

Clear is not finished. Release the error by resetting the power.

12.9 Automatic offset adjustment

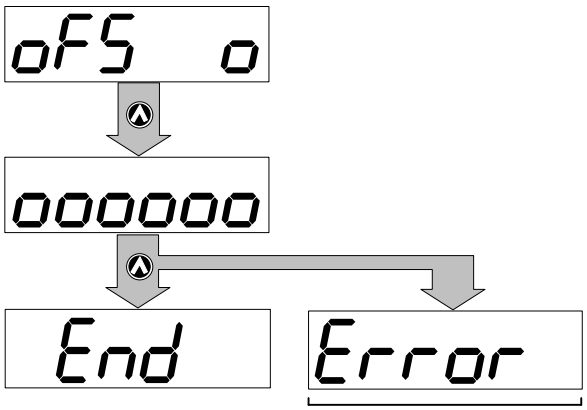
12.9.1 How to enter the automatic offset adjustment mode

From the initial state of LED, press MODE five times to enter into auxiliary function mode. Press ▲▼ to display Au oFS.

12.9.2 Execute automatic offset adjustment

Press SET to display Au oFS.

"0" increases while keep pressing ▲ (for approx. 5sec)



Adjustment finishes.

Automatic offset adjustment finishes.

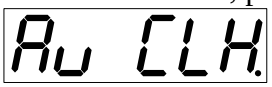
Error occurs. Invalid mode is selected, or offset value exceeds the setup range of Pr52.

Note:

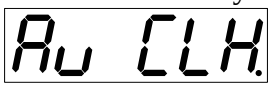
- This function is invalid at position control mode.
- You cannot write the data only by executing automatic offset adjustment.
- Execute writing to EEPROM when you need to reflect the result afterward.

12.10 Alarm history clear

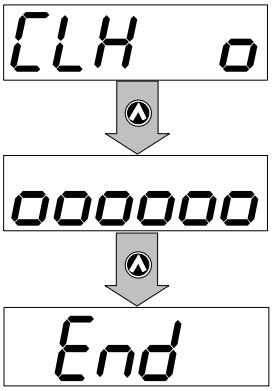
12.10.1How to enter the alarm history clear mode

From the initial state of LED, press MODE five times to enter into auxiliary function mode. Press ▲▼ to display 

12.10.2Execute the alarm history clear mode

Press SET to display 

"0" increases while keep pressing ▲ (for approx. 5sec)



End

Alarm history clear finishes.

Note:

The function can clear the abnormal records.

13. Parameters

13.1 Introduction of Parameters

The driver provides parameters for setting features and functions to fit the different requirement of users. The chapter will introduce the function of each parameter. Read it carefully and adjust parameters to the best operating condition before application.

13.2 Setting Method

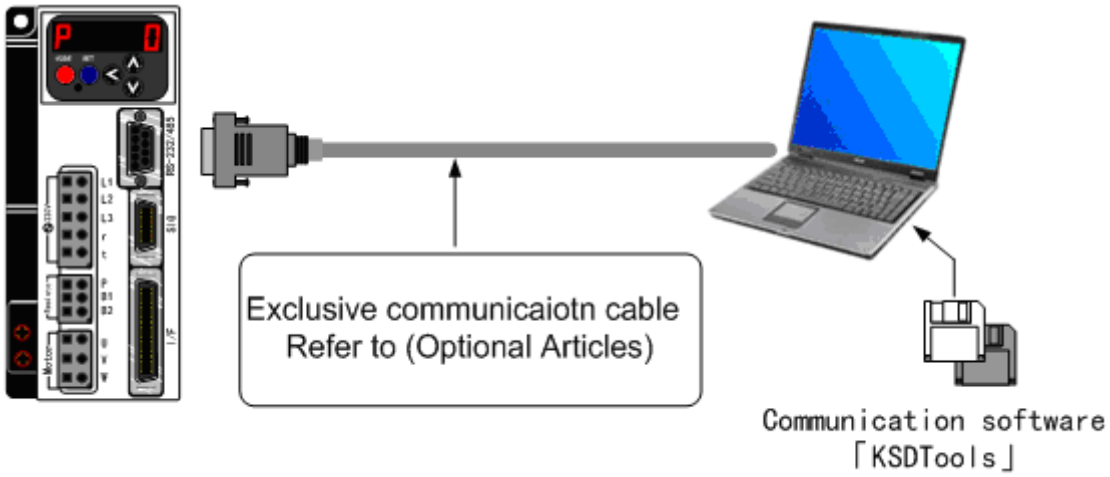
The setting method of parameters is as following:

1. Front panel of machine
2. Set up supporting software KSDTools in computer.

Note:

About the setting method of computer screen, refer to the manual of KSDTools.

13.3 Connection Method



13.4 Contents and List of parameters

Type	Parameter No. (Pr□□)	Abstract
Function Selection	00 to 0F	selection of control mode, designation of input/output signal, setting of communication transition rate etc.
Adjustment	10 to 20 27 to 2B	(first and second)servo gain of position, speed and integral etc. or setting of time constant of all filters. External noise detector, CCW and CW torque control offset etc.
	30 to 3D	shift related setting of the first gain to the second gain.
Position Control	40 to 4D	setting of input form and direction of command pulse, setting of division of output pulse of encoder and setting of division rate of command pulse etc.
Speed/Torque Control	50 to 5A 74 to 77	input gain setting, rotary limit setting and offset adjustment of speed commander, internal speed(1 to 4 level) setting and setting of accelerating/decelerating time etc.
	5B to 5E	input gain setting, rotary limit setting and offset adjustment of torque commander
Process	60 to 6C	setting of output signal detection condition of in-position, zero speed attainment etc. while main power off, alarm occurs and Servo OFF, speed down operation or setting of release condition of differential counter.

More information, refer to the parameter setting of all control modes.

The introduction of marks of all modes is as following.

Mark	Control Mode	Setting value of Pr02
P	position control	0
S	speed control	1
T	torque control	2

Mark	Control Mode	Setting value of Pr02
P/S	Position(first)and speed(second) control	3＊
P/T	Position(first)and torque(second) control	4＊
S/T	Speed(first)and torque(second) control	5＊

Note:

1. If 3, 4and 5 complex modes are set, one of the first and second modes can be chosen according to control mode shift input (C-MODE).

-While C-MODE is broken circuit, the first mode is chosen

-While C-MODE is short circuit, the second mode is chosen.

2. 10ms before and after of shift change, don’t input other command.

13.4.1 Parameters for function selection

Parameter No. (Pr□□)	Function	Pre-set value	Range	Unit	Applicable Mode
★00	(Used by Manufacturer)				
★01	LED initial display state	0	0~13	-	All
★02	Control mode setting	0	0~5	-	All
03	analog torque limit	1	0~2	-	P，S
★04	Over-travel protection input	1	0~2	-	All
05	Internal/external speed selection	0	0~3	-	S
06	Invalid zero speed clamp	0	0~2	-	S，T
07	Speed monitor option	3	0~9	-	All
08	Torque monitor option	0	0~7	-	All
09	Output option during torque limit	0	0~4	-	All
0A	Output option of zero speed detection	1	0~4	-	All
★0C	Setting of RS232C communication baud rate	3	0~3	-	All

● Modification of parameter No. marked with ★ will be effective only after control power is reset.

【】：Factory default value

★：Control power need be restarted while modifying parameters.

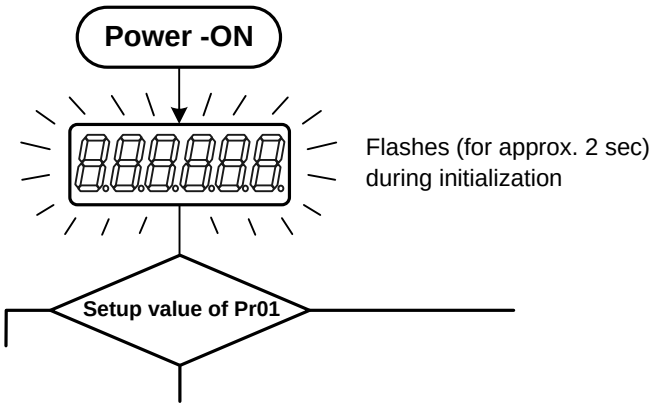
Pr01 LED Initial display★

Initial Value：【0】

Setting Range：0~13

Unit：–

Function：You can select the type of data to be displayed on the front panel LED (7 segment) at the initial state



Set Value	Contents
【0】	Position Deviation
1	Rotary Speed of Motor
2	Torque Output
3	Cont ol Mode
4	I/O Signal State
5	Abnormality Record
6	Software Version
7	Warning Notice
8	Regeneration Load Ratio
9	Overload Load Ratio
10	Inertia ratio
11	Sum of Feedback Pulse
12	Sum of Command Pulse
13	Analog Input Value

Pr02 Setting of control mode★

Initial Value：【0】

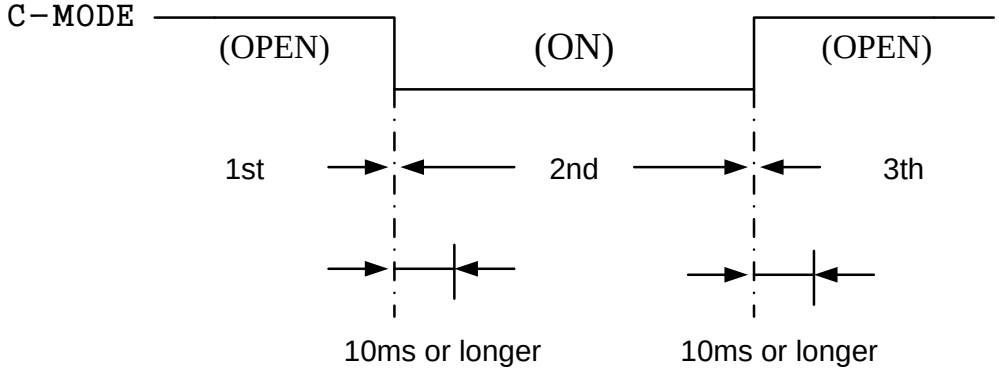
Setting Range：0~5

Unit：–

Function：You can set up the control mode to be used.

Setting Value	Control Mode	
	First Mode	Second Mode
【0】	Position	—
1	Speed	—
2	Torque	—
3	Position	Speed
4	Position	Torque
5	Speed	Torque

If setting is a complex mode (Pr02=3,4,5), control mode shift input (C-MODE) is used to make shift between first and second mode.



Note:

Don't enter commands 10ms before/after switching. Neither position, speed nor torque instructions are not allowed to input.

Pr03 Analog torque limit input

Initial Value：【1】

Setting Range：0~2

Unit：–

Function：You can set up the torque limiting method for CCW/CW direction.

If not using torque limit function, set Pr03 to “1”.

Use angle torque limit input (CCWTL：Pin16, CWTL：Pin18) CCWTL and CWTL will be limited by Pr5E

Setting Value	CCW torque limit	CW torque limit
0	limit by Pin16 input	limit by Pin18 input
【1】	limit by setting value of Pr5E	
2	limit by setting value of Pr5E	limit by setting value of Pr5F

In torque control mode this parameter is invalid and CCW/CW torque limited by setting value of Pr5E.

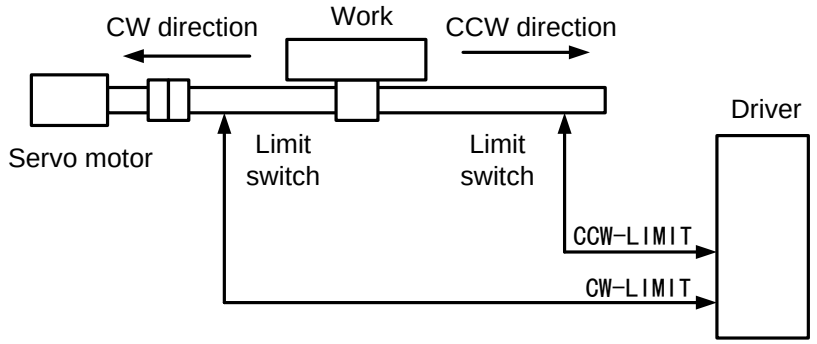
Pr04 Over-travel limit input★

Initial Value：【1】

Setting Range：0~2

Unit：–

Function：In linear drive application, you can use this over-travel limit function to inhibit the motor to run to the direction specified by limit switches which are installed at both ends of the axis, so that you can prevent the work load from damaging the machine due to the over-travel. With this input, you can set up the action of over-travel protection input.



Set Value	CCW-LIMIT/ CW-LIMIT Input	Input	Connect COM-	Action
0	Valid	CCW-LIMIT (CN I/F,Pin-9)	Close	Close normal state of limit switch in the end of CCW
			Open	CCW is prohibited
		CW-LIMIT (CN I/F,Pin-8)	Close	Close normal state of limit switch in the end of CW
			Open	CW is prohibited
【1】	Invalid	Ignore CCW-LIMIT/CW-LIMIT input， over-travel protection function is invalid		
2	Valid	If one of CCW/CW inhibition inputs is open circuit with COM-, Err38(Over-travel protection) occurs.		

Note:

1. When Pr04 setting is 0 and over-travel protection input is valid, program set by Pr66(Sequence at over-travel protection input) is used to make speed-down and cease. For detail, refer to instruction of Pr66.
2. If Pr04 setting is 0 and CCW-LIMIT and CW-LIMIT input is open meanwhile, driver is judged as abnormal state, Err38(Run-inhibition input protection) will occur.
3. When you turn off the limit switch on upper side of the work at vertical axis application, the work may repeat up/down movement because of the loosing of upward torque. In this case, set up Pr66 to 2, or limit with the host controller instead of using this function.

Pr05　Speed selection mode

Initial Value：【0】

Setting Range：0~3

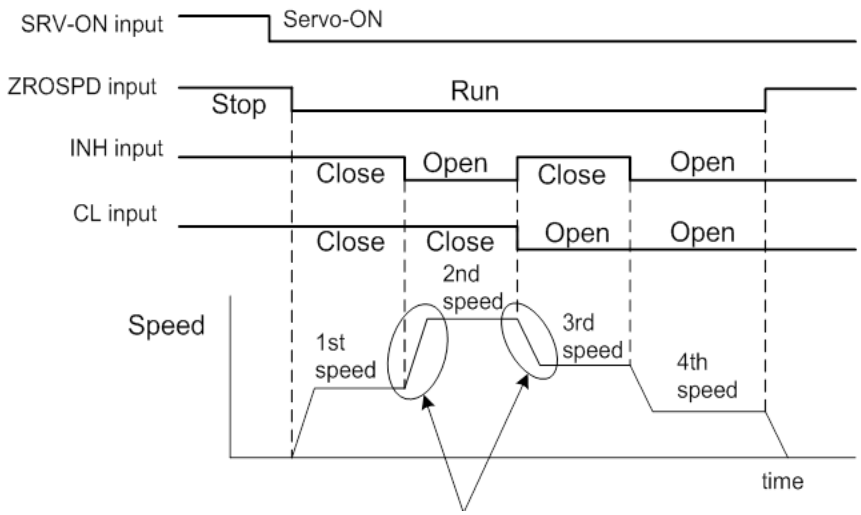
Unit：–

Function：This driver is equipped with internal speed setting function so that you can control the speed with contact inputs only.

- Set the validity of internal speed setting.
- 8 types of internal speed. Their instruction data are setting by Pr53（1st speed）、Pr54（2nd speed）,Pr55（3rd speed）,Pr56（4th speed）,Pr74（5th speed）,Pr75（6th speed）,Pr76（7th speed）and Pr77（8th speed）
- PULS-INH（CN I/F，Pin-33,）CLR（CN I/F，Pin-30, DIV（CN I/F，Pin-28）are external selection input. The combination results are shown as follows.

PULS-INH (Pin-33)	CLR (Pin-30)	DIV (Pin-28)	Pr05 Setting Value			
			0	1	2	3
OFF	OFF	OFF	Analog speed command (CN I/F，Pin-14)	1st speed of internal speed（Pr53）	1st speed of internal speed（Pr53）	1st speed of internal speed（Pr53）
ON	OFF	OFF	Analog speed command (CN I/F，Pin-14)	2nd speed of internal speed（Pr54）	2nd speed of internal speed（Pr54）	2nd speed of internal speed（Pr54）
OFF	ON	OFF	Analog speed command (CN I/F，Pin-14)	3rd speed of internal speed（Pr55）	3rd speed of internal speed（Pr55）	3rd speed of internal speed（Pr55）
ON	ON	OFF	Analog speed command (CN I/F，Pin-14)	4th speed of internal speed（Pr56）	Analog speed command (CN I/F，Pin-14)	4th speed of internal speed（Pr56）
OFF	OFF	ON	Analog speed command (CN I/F，Pin-14)	1st speed of internal speed（Pr53）	1st speed of internal speed（Pr53）	5th speed of internal speed（Pr74）
ON	OFF	ON	Analog speed command (CN I/F，Pin-14)	2nd speed of internal speed（Pr54）	2nd speed of internal speed（Pr54）	6th speed of internal speed（Pr75）
OFF	ON	ON	Analog speed command (CN I/F，Pin-14)	3rd speed of internal speed（Pr55）	3rd speed of internal speed（Pr55）	7th speed of internal speed（Pr76）
ON	ON	ON	Analog speed command (CN I/F，Pin-14)	4th speed of internal speed（Pr56）	Analog speed command (CN I/F，Pin-14)	8th speed of internal speed（Pr77）

- 4 speed examples using internal speed instruction.
  - Set Pr05=1 (4 speed by external switch)
  - Set Pr06=1 (ZERO-SPD as run/stop control input)
  - Use PULS-INH and CLR as speed selection input



You can individually setup the acceleration and deceleration time of the speed.
Pr58: acceleration time setup
Pr59: deceleration time setup
Pr5A: S-curve acc/dec time setup

Pr06 Selection of ZERO-SPD input

Initial Value：【0】

Setting Range：0~2

Unit：–

Function：Set zero speed clamp input (ZERO-SPD：CN I/F PIN 26）.

Setting Value	ZERO-SPD Input（PIN 26）
【0】	Ignore ZERO-SPD input.
1	ZERO-SPD input; if open with COM-, speed command is 0 (stop) else run.
2	Direction input; If open with COM-, speed command direction is CCW; if keeping short circuit with COM-, speed direction is CW.

Pr07 Selection of speed monitor (SP)

Initial Value：【3】
Setting Range：0~9
Unit：–
Function：Make choice and set the relation voltage to speed monitor signal output (SPM:CN I/F PIN 43) of motor's actual speed and command speed.

Setting Value	SPM Signal	Relation Between Output Voltage Level and Speed
【0】	Motor speed	6V/375rpm
1		6V/750rpm
2		6V/1500rpm
3		6V/3000rpm
4		6V/6000rpm
5	Command speed	6V/375rpm
6		6V/750rpm
7		6V/1500rpm
8		6V/3000rpm
9		6V/6000rpm

Pr08 Selection of torque monitor (TM)

Initial Value：【0】
Setting Range：0~7
Unit：–
Function：Set relation between output level of analog torque monitor signal(TM:CN I/F,PIN 42) or deviation pulse number.

Setting Value	TM Signal	Relation Between Output Level and TM or Deviation Pulse Number
【0】	Torque	3V/100%
1		3V/200%
2		3V/300%
3	Position Deviation	3V/31p
4		3V/125p
5		3V/500p
6		3V/2000p
7		3V/8000p

Pr09 Selection of TLC output

Initial Value：【0】

Setting Range：0~4

Unit：–

Function：Assign the functions of TLC output (TLC: CN I/F PIN 40).

Setting Value	Function	Mark of Signal	TLC output condition
0	Output during torque limit	TLC	Torque command in Torque limit
1	Zero speed detection output	ZSP	Speed lower than Pr61
2	regeneration Warning output	WARN ALL	regeneration higher or overload
3	Over- regeneration warning output	WARN REG	regeneration more than 85%
4	Overload warning output	WARN OL	Load more than 85%

Pr0A Selection of ZSP output

Initial Value：【0】

Setting Range：0~4

Unit：–

Function：Function of ZSP output (ZSP:CN I/F PIN 12).

Setting Value	Function	Mark of Signal	TLC output condition
0	Output during torque limit	TLC	Torque command in Torque limit
1	Zero speed detection output	ZSP	Speed lower than Pr61
2	regeneration Warning output	WARN ALL	regeneration higher or overload
3	Over- regeneration warning output	WARN REG	regeneration more than 85%
4	Overload warning output	WARN OL	Load more than 85%

Pr0C Baud rate setting of RS232 communication★

Initial Value：【3】

Setting Range：0~3

Unit：–

Function：You can set up the communication speed of RS232.

Setting Value	Baud
0	19200bps
1	38400bps
2	57600bps
3	115200bps

13.4.2 Parameters for adjustment of time constants of gain and filters

Parameter No.(Pr□□)	Function	Pre-set value	Range	Unit	Applicable Mode
10	First position loop gain	47	1~2000	1/S	P
11	First speed loop gain	36	1~3500	Hz	All
12	Time constant of first speed loop integral	28	0~1000	0.01ms	All
13	First speed detection filter	0	0~5	-	All
14	Time constant of first torque filter	65	25~2500	0.01ms	All
15	Speed feed-forward	300	0~1500	0.1%	P
16	Time constant of speed feed-forward filter	50	0~6400	0.01ms	P
18	Second position loop gain	54	1~2000	1/S	P
19	Second speed loop gain	36	1~3500	Hz	All
1A	Time constant of second speed loop integral	130	0~1000	ms	All
1B	Second speed detection filter	0	0~5	-	All
1C	Time constant of second torque filter	65	25~2500	0.01ms	All
1D	First notch filter frequency	1600	50~1600	Hz	All
1E	First notch filter width	4	0~4	-	All
20	Inertia ratio	0	0~10000	-	All
21	Real-time Auto-gain	0	0~7	-	All
22	Real-time Auto-gain stiffness	4	0~15	-	All
25	Off-line Auto-gain	0	0~7	-	All
27	External noise detection	0	0~8	-	All
28	Second external noise filter	1600	100~1600	Hz	All
29	Second external noise filter width	2	0~4	-	All
2A	Second external noise filter depth	0	0~99	-	All

PR10 1st position loop gain

Initial Value：【47】

Setting Range：1~2000

Unit：1/s

Function：You can determine the response of the positional control system. The higher gain of position loop you set, the faster positioning time you can obtain. Note that gain too high may cause oscillation.

Pr11 1st velocity loop gain

Initial Value：【36】

Setting Range：1~3500

Unit：Hz

Function：You can determine the response of the velocity loop. In order to increase the response of overall servo system by setting high position loop gain; you also need setting of higher velocity loop gain as well. However, too high setting may cause oscillation.

Pr12 1st time constant of velocity loop integration

Initial Value：【28】

Setting Range：1~1000

Unit：ms

Function：You can set up the integration time constant of velocity loop. Smaller the setting, faster you can dock-in deviation at stall to 0.The integration will be maintained by setting to "999". The integration effect will be lost by setting to "1000".

Pr13 1st speed detection filter

Initial Value：【0】

Setting Range：0~5

Unit：–

Function：You can set up the time constant of the low pass filter (LPF) after the speed detection, in one of 6 steps. Higher the setting, larger the time constant you can obtain so that you can decrease the motor noise, however, response becomes slow. Use with a default value of 0 in normal operation.

Pr14 1st time constant of torque filter

Initial Value：【65】

Setting Range：25~2500

Unit：0.01ms

Function：Set time constant of time delay filter in the torque command section.

Pr15 Velocity feed forward

Initial Value：【300】

Setting Range：0~1500

Unit：0.1%

Function：Set up the velocity feed forward percentage at position control loop. Higher the setting, smaller position deviation and better response you can obtain, however this might cause an overshoot.

Pr16 Time constant of feed forward filter

Initial Value：【50】

Setting Range：0~6400

Unit：0.01ms

Function：Set up the time constant of 1st delay filter in velocity feed forward loop. You might expect to improve the overshoot or noise caused by larger setting of velocity feed forward (Pr15).

Pr18 2nd position loop gain

Initial Value：【54】

Setting Range：1~2000

Unit：1/s

Function：There are 2 sets of position loop, velocity loop, speed detection filter and torque command filter. The 2nd set has the same property and function as 1st one. Refer Pr10. for more detail.

Pr19 2nd velocity loop gain

Initial Value：【36】
Initial Value：【36】
Setting Range：1~3500
Unit：Hz
Function：Refer to Pr11

Pr1A 2nd time constant of velocity loop integration

Initial Value：【130】
Setting Range：1~1000
Unit：ms
Function：Refer to Pr12

Pr1B 2nd speed detection filter

Initial Value：【0】
Setting Range：0~5
Unit：–
Function：Refer to Pr13

Pr1C 2nd time constant of torque filter

Initial Value：【65】
Setting Range：25~2500
Unit：0.01ms
Function：Refer to Pr14

Pr1D 1st notch filter frequency

Initial Value：【1600】
Setting Range：50~1600
Unit：Hz
Function：Set up the frequency of the 1st resonance suppressing notch filter. The notch filter function will be invalidated by setting up this parameter to"1600".

Pr1E 1st notch width selection

Initial Value：【4】
Setting Range：0~4
Unit：–
Function：Set up the notch filter width of the 1st resonance suppressing filter in one of 5 steps. Higher the setting, larger the notch width you can obtain. Use with default setting in normal operation.

Pr20 Inertia ratio

Initial Value：【0】

Setting Range：0~10000

Unit：%

Function：You can set up the ratio of the load inertia against the rotor (of the motor) inertia.

Pr20 = (load inertia/rotor inertia) x 100 [%]

Note:

If the inertia ratio is correctly set, the setting unit of Pr11 and Pr19 becomes (Hz). When the inertia ratio of Pr20 is larger than the actual, the setting unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr20 is smaller than the actual, the setting unit of the velocity loop gain becomes smaller.

Pr21 Real time auto gain

Initial Value：【0】

Setting Range：0~7

Unit：–

Function：Set up the action mode of the real-time auto-gain tuning. With higher setting such as 3 or 6, the driver responds quickly to the change of the inertia during operation, however it might cause an unstable operation. Use 1 or 4 for normal operation. For the vertical axis application, use with the setting of 4 to 6.

Setting Value	Real-time auto-gain	Load inertia
【0】	Turn off	
1	Slower learning rate	Almost no change
2		
3	Normal learning rate	Change moderately
4		
5		
6	Fast learning rate	Fast changes
7		

Setting is "0", it will turn off real-time auto-gain adjustment function.

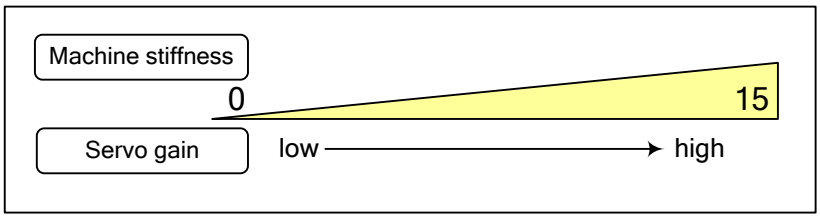
Pr22 real time auto-gain stiffness

Initial Value：【0】

Setting Range：0~15

Unit：%

Function：Set up the machine stiffness in one of 16 steps while the real-time auto gain tuning is valid.



Note:

As the stiffness changed, the servo gain changed as well and this may damage to the machine owing to overshoot or oscillation. Increase the setting from 0 to 15 gradually and watch the movement of the machine until machine stable.

Pr25 Off line auto gain

Initial Value：【0】

Setting Range：0~7

Unit：%

Function：Set up the action pattern at the off-line auto-gain tuning.

When the setting is 0, the motor turns 2 revolutions to CCW after 2 revolutions to CW, 5 times of execution.

Setting Value	Rotational direction	Number of revolution
【0】	CCW → CW	2 revolution(CCW → CW)
1	CW → CCW	2 revolution(CW → CCW)
2	CCW →	2 revolution(only CCW)
3	CW →	2 revolution(only CW)
4	CCW → CW	1 revolution(CCW → CW)
5	CW → CCW	1 revolution(CW → CCW)
6	CCW →	1 revolution(only CCW)
7	CW →	1 revolution(only CW)

Pr27 External noise observer

Initial Value：【0】

Setting Range：0~8

Unit：–

Function：Set compensation value of external torque noise observer to improve stability of speed loop. The higher compensation value, the faster response it will be. However, large setting value can easily cause resonance noise.

※If load mechanism is the mechanism with intensely changing inertia, this function is not suitable to use and shall be set to 0.

Pr28 2nd external noise filter

Initial Value：【1600】

Setting Range：100~1600

Unit：Hz

Function：The second external Noise filter frequency setting.

Pr29 2nd external noise filter width

Initial Value：【2】

Setting Range：0~4

Unit：-

Function：The second external Noise filter width in one of 5 step setting.

Higher the setting, larger the notch width you can obtain. Use with default setting in normal operation.

Pr2A 2nd external noise filter depth

Initial Value：【0】

Setting Range：0~99

Unit：-

Function：Set up the second external noise filter depth of the resonance suppressing filter. Higher the setting, shallower the notch depth and smaller the phase delay you can obtain.

13.4.3 Parameters for adjustment of 2nd gain

Parameter No.(Pr□□)	Function	Pre-set Value	Range	Unit	Applicable Mode
30	Second gain action setting	0	0~1	-	All
31	Position control shift mode	7	0~8	-	P
32	Position control shift delay time	5	0~10000	ms	P
33	Position control shift level	100	0~10000	-	P
34	Position control shift width	30	0~10000	-	P
35	Position gain shift time	4	0~10000	(set value+1)ms	P
36	Speed control shift mode	0	0~5	-	S
37	Speed control shift delay time	0	0~10000	ms	S
38	Speed control shift level	0	0~10000	-	S
39	Speed control shift width	0	0~10000	-	S
3A	Torque control shift mode	0	0~3	-	T
3B	Torque control shift delay time	0	0~10000	ms	T
3C	Torque control shift level	0	0~10000	-	T
3D	Torque control shift width	0	0~10000	-	T

Pr30 setting of 2nd gain

Initial Value：【0】

Setting Range：0~1

Unit：–

Function：You can select the PI/P action switching of the velocity control or 1st/2nd gain switching.

Setting Value	Gain Option and shift
0	1st gain (PI/P switching enabled)
1	1st/2nd gain switching enabled

Switch the PI/P action with the gain switching input (Pin-27).

GAIN Input	Speed Loop Action
Open with COM-	PI Action
Connection with COM-	P Action

Pr31 1st mode of control switching

Initial Value：【7】

Setting Range：0~8

Unit：－

Function：You can select the switching condition of 1st gain and 2nd gain while Pr30 is set to 1.

Setting Value	Gain Shift Condition
0	Fix to the 1st gain.
1	Fix to the 2nd gain.
2	As gain switch input（GAIN）is ON, select 2nd gain (Pr30 set to 1).
3	2nd gain selection when the toque command variation is larger than the settings of Pr33 (1st level of control switching) and Pr34 (1st hysteresis of control switching).
4	Fixed to the 1st gain.
5	2nd gain selection when the command speed is larger than the settings of Pr33 (1st level of control switching) and Pr34 (1st hysteresis at control switching).
6	2nd gain selection when the position deviation is larger than the settings of Pr33 (1st control switching level) and Pr34 (1st hysteresis of control switching).
7	2nd gain selection when more than one command pulse exist
8	2nd gain selection when the position deviation counter value exceeds the setting of Pr60 (Positioning complete range).

Pr32 1st delay time of control switching

Initial Value：【5】

Setting Range：0~10000

Unit：ms

Function：You can set up the delay time when returning from the 2nd to the 1st gain, while Pr31 is set to 3、5、6、7、8.

Pr33 1st level of control switching

Initial Value：【100】

Setting Range：0~10000

Unit：－

Function：It is valid as Pr31 is set to 3, 5, 6, 7, 8. It determines the level of first/second gain shift.

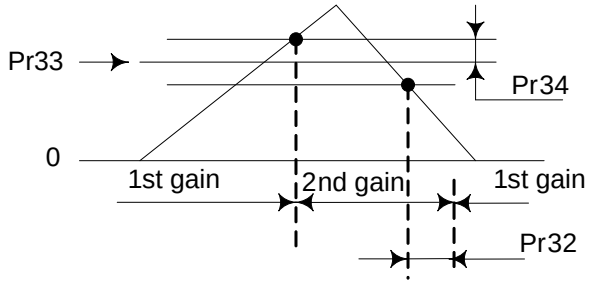
Pr34 1st hysteresis of control switching

Initial Value：【30】

Setting Range：0~10000

Unit：–

Function：Set up hysteresis range above/below the comparison level which is set up with Pr33. Unit varies depending on the setting of Pr31 (1st control switching mode). Definitions of Pr32 (Delay), Pr33 (Level) and Pr34 (Hysteresis) are explained in the fig. below.



Pr35 Switching time of position gain

Initial Value：【4】

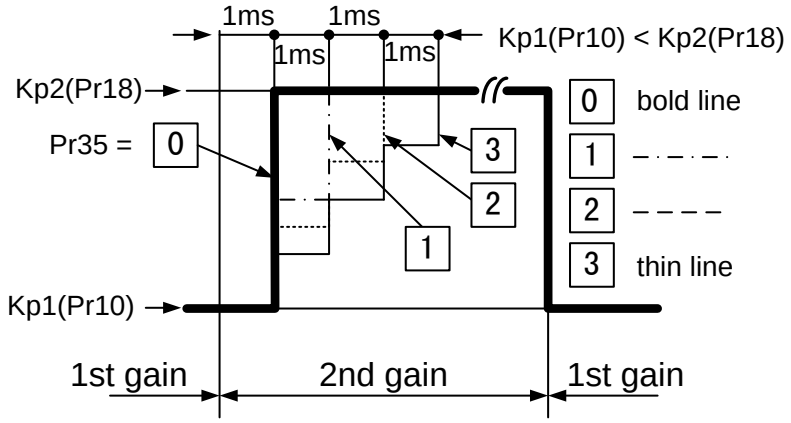
Setting Range：0~10000

Unit：ms

Function：Setting the step-by-step switching time to the position loop gain only at gain switching while the 1st and the 2nd gain switching is valid.

Switching time= (setting value+1) ms

e.g.)



Note:

The switching time is only valid when switching from small position gain to large position gain.

Pr36 Speed control shift mode

Initial Value：【0】

Setting Range：0~5

Unit：－

Function：In speed control mode, make choice to the shift condition of first/second gain. It's the content that eliminates position control section in Pr31(Position control shift mode).

Setting Value	Gain Shift Condition
0	Fix to First Gain
1	Fix to Second Gain
2	As gain switch input（GAIN）is ON, select 2nd gain (Pr30 set to 1).
3	2nd gain selection when the toque command variation is larger than the settings of Pr33 (1st level of control switching) and Pr34 (1st hysteresis of control switching).
4	Fix to First Gain
5	2nd gain selection when the command speed is larger than the settings of Pr33 (1st level of control switching) and Pr34 (1st hysteresis at control switching).

Pr37 2nd delay time of control switching

Initial Value：【0】

Setting Range：0~10000

Unit：ms

Function：The content is same with following ones in position control mode.

Pr32：Shift delay time

Pr33：Shift level

Pr34：Shift level width

Pr38 2nd level of controls witching

Initial Value：【0】

Setting Range：0~10000

Unit：－

Function：Refer to Pr32, Pr33, Pr34

Pr39 2nd hysteresis of control switching

Initial Value：【0】

Setting Range：0~10000

Unit：－

Function：Refer to Pr32, Pr33, Pr34

Pr3A 1st mode of control switching

Initial Value：【0】

Setting Range：0~3

Unit：－

Function：You can select the switching condition of 1st gain and 2nd gain while Pr31 is set to 1.

Setting Value	Gain Shift Condition
0	Fix to First Gain
1	Fix to Second Gain
2	As gain shift input（GAIN）is ON, select 2nd gain (Pr30 must be set to 1).
3	2nd gain selection when the toque command variation is larger than the settings of Pr33 (1st level of control switching) and Pr34 (1st hysteresis of control switching).

Pr3B Torque control shift delay time

Initial Value：【0】

Setting Range：0~10000

Unit：ms

Function：The content is same with following ones in position control mode.

Pr32：Shift delay time

Pr33：Shift level

Pr34：Shift level width

Pr3C Torque control shift level

Initial Value：【0】

Setting Range：0~10000

Unit：–

Function：Refer to Pr3B

Pr3D Torque control shift level width

Initial Value：【0】

Setting Range：0~10000

Unit：–

Function：Refer to Pr3B

13.4.4 Parameters for position control

Parameter No.(Pr□□)	Function	Pre-set Value	Range	Unit	Applicable Mode
★40	Command pulse input option	0	0~1	-	P
★41	Command pulse reverse	0	0~1	-	P
★42	Pulse input mode setting	1	0~3	-	P
43	Invalid input command pulse inhibition	1	0~1	-	P
★44	Output pulse pre-division of every reversion	0	1~255	-	P
★45	Feedback pulse output logic RP	0	0~1	-	P
46	First instruction electric gear numerator	1	1~10000	-	P
47	Second instruction electric gear numerator	1	1~10000	-	P
★48	FIR smooth setting	0	0~3	-	P
4A	Electric gear numerator rate	0	0~17	-	P
4B	Electric gear denominator	1	1~10000	-	P
4C	Smooth filter setting	1	0~7	-	P
4D	Counter clearance input mode	1	0~2	-	P
★4E	Numerator of pulse output division	10000	1~10000	-	All
★4F	Denominator of pulse output division	1	1~255	-	All

● Modification of parameter No. marked with ★ will be effective only after control power is reset.

Pr40 ★Selection of command pulse input

Initial Value：【0】

Setting Range：0~1

Unit：－

Function：You can select either the photo-coupler input or the exclusive input for line driver as the command pulse input.

Setting Value	Content
【0】	Photo-coupler input (I/F PULS1:Pin-3, PULS2:Pin-4, SIGN1:Pin-5, SIGN2:Pin-6)
1	Exclusive input for line driver (I/FPULSH1:Pin-44, PULSH2:Pin-45, SIGNH1:Pin-46, SIGNH2:Pin-47)

Note:

Photo-coupler input command frequency ≦500kpps

Exclusive input for line driver command frequency ≦2Mpps

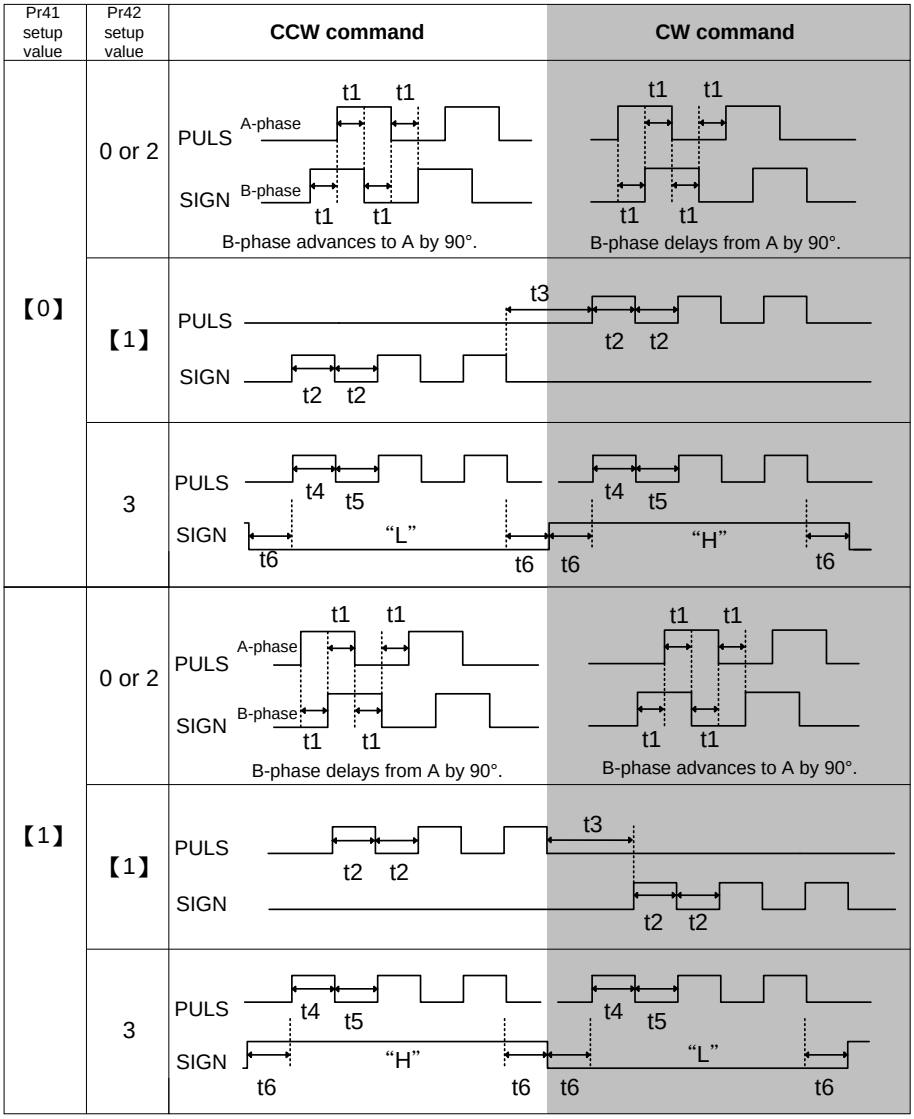
Pr41 ★Command pulse to rotation direction

Initial Value：【0】

Setting Range：0~1

Unit：–

Function：You can set up the rotational direction against the command pulse input, and the command pulse input format.



•Permissible max. input frequency, and min. necessary time width of command pulse input signal.

Input I/F of PULS/SIGN signal		Permissible max. input frequency	Min. necessary time width					
			t1	t2	t3	t4	t5	t6
Pulse train interface exclusive to line driver		2Mpps	500ns	250ns	250ns	250ns	250ns	250ns
Pulse train interface	Line driver interface	500kpps	2μs	1μs	1μs	1μs	1μs	1μs
	Open collector interface	200kpps	5μs	2.5μs	2.5μs	2.5μs	2.5μs	2.5μs

Make the rising/falling time of the command pulse input signal to 0.1μs or smaller.

Note: Pr41=0,

Pr42=0 or 2 Command pulse format is 90° phase difference 2-phase pulse(A + B-phase)

Pr42=1 Command pulse format is CW pulse train + CCW pulse train

Pr42=3 Command pulse format is pulse train + direction signal

Pr41=1 will invert the above setting of Pr42

Pr42 ★ Setting of command pulse input mode

Initial Value：【1】
Setting Range：0~3
Unit：－
Function：refer description of Pr41

Pr43 Enable/disable command pulse inhibit input

Initial Value：【1】
Setting Range：0~1
Unit：－
Function：You can select either the enable or the disable of the command pulse inhibit input (INH : CN I/F Pin-33).

Setting Value	PULS-INH Input
0	Valid
1	Invalid

Command pulse input will be inhibited by opening the connection of INH input to COM. When you do not use INH input, set up Pr43 to 1 to invalid the function that you do not need to connect INH (CN I/F Pin-33) and COM– (Pin-41).

Pr44 ★Output pulse pre-division of every revolution

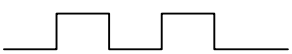
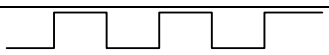
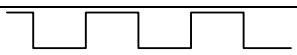
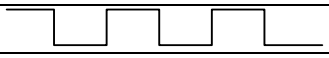
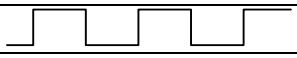
Initial Value：【0】
Setting Range：0~225
Unit：－
Function：Set pre-division of one revolution pulse number of encoder pulse input to upper-level device.

Pulse output per revolution = Encoder resolution / Pr44

When Pr44≠0，Pr4E、Pr4F setting is invalid.

Pr45 ★Normal/invert of pulse output

Initial Value：【0】
Setting Range：0~1
Unit：－
Function：You can set up the B-phase logic and the output source of the pulse output (I/F OB+: Pin-48, OB– : Pin-49). With this parameter, you can change lead/lag of the phase relation between the A-phase and the B-phase by inverting the B-phase logic.

Setting value	A-phase (OA)	at motor CCW rotation	at motor CW rotation
			
0	B-phase(OB) normal		
1	B-phase(OB) invert		

Pr46 1st numerator of electronic gear

Initial Value：【1】

Setting Range：1~10000

Unit：–

Function：Electronic gear (Command pulse division/multiplication) function

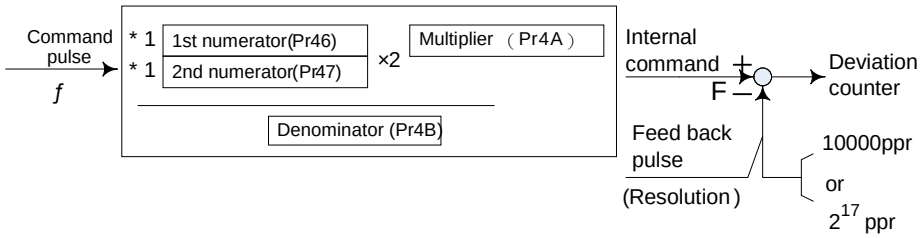
• Purpose of this function

(1) You can set up any motor revolution and travel distance per input command unit.

(2) You can increase the nominal command pulse frequency when you cannot obtain the required speed due to the limit of pulse generator of the host controller.

• Block diagram of electronic gear

The upper limit of numerator is 2621440. If setting value is over upper limit, then numerator value will be limited to 2621440.



“Numerator" selection of electronic gear

Select the 1st or the 2nd with the command electronic gear input switching (DIV : CN I/F, Pin-28)

DIV input open	Selection of 1st numerator（Pr46）
DIV input connect to COM–	Selection of 2nd numerator（Pr47）

Setting example when numerator≠0

Take Mokon-K servo motor with 10,000ppr encoder (in general condition)

• If division/multiplication ratio=1, it is essential to keep the relationship in which the motor turns one revolution with the command input (f) of the encoder resolution; ie. 10,000 pulses will run one revolution.

• If you want to enter the input of f=5,000pulses to run one revolution, set the division/multiplication ratio=2

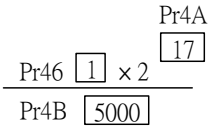
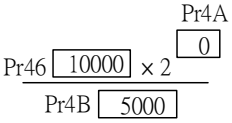
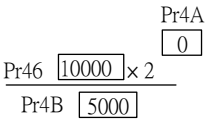
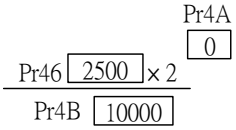
• If you set division/multiplication ratio= ¼ then you need to apply 10,000*4 pulses to run one revolution.

• Set up Pr46, 4A and 4B so that the internal command (F) after division / multiplication may equal to the encoder resolution (10000 or 2^{17}).

$$F = f \times \frac{Pr46 \times 2^{Pr4A}}{Pr4B} = 10000 \text{ or } 2^{17}$$

F：Internal command pulse counts per motor one revolution

f：Command pulse counts per one motor revolution.

Encoder resolution	2^{17} (131072)	10000 (2500 ppr × 4)
Example 1 when making the command input (f) as 5000 per one motor revolution		
Example 2 when making the command input (f) as 40000 per one motor revolution		

Pr47 | 2nd numerator of electronic gear

Initial Value：【1】
Setting Range：1~10000
Unit：－
Function：Refer to Pr46

Pr 48 ★Setting of FIR smoothing

Initial Value：【0】
Setting Range：0~3
Unit：－
Function：You can set up the moving average times of the FIR filter covering the command pulse. (Setting value + 1) become average travel times.

Pr4A Multiplier of electronic gear numerator

Initial Value：【0】
Setting Range：0~17
Unit：－
Function：Refer to Pr46

Pr4B denominator of electronic gear

Initial Value：【1】
Setting Range：1~10000
Unit：－
Function：Refer to Pr46

Pr4C Steup of primary delay smoothing

Initial Value：【1】

Setting Range：0~7

Unit：－

Function：Smoothing filter is the filter for primary delay which is inserted after the electronic gear.

Purpose of smoothing filter

• Reduce the step motion of the motor while the command pulse acceleration/deceleration rate is rough.

• Actual examples which cause rough command pulse are;

(1) when you set up a high multiplier ratio (10 times or more).

(2) when the command pulse frequency is low.

You can set the time constant of the smoothing filter in 8 steps with Pr4C.

Setting value	Time Constant
0	No filter function
1	Time constant small
↓	↓
7	Time constant large

Pr4D Counter clear input mode

Initial Value：【0】

Setting Range：0~2

Unit：－

Function：You can set up the clearing conditions of the counter clear input signal which clears the deviation counter.

Setting Value	Clearing condition
0	Clears the deviation counter at level (shorting for longer than 100us)
1	Clears the deviation counter at falling edge (open for longer than 100us)
2	Invalid

Pr4E ★Numerator of pulse output division

Initial Value：【10000】

Setting Range：1~10000

Unit：-

Function：You can set up the pulse counts to be fed out from the pulse output (CN I/F 0A+ : Pin-21, 0A- : Pin-22, 0B+ : Pin-48, 0B- : Pin-49).

•When Pr44≠0，Pr4E、Pr4F setting is invalid.

Pr4F ★Denominator of pulse output division

Initial Value：【1】

Setting Range：1~255

Unit：-

Function：Refer to Pr4E

Pr44=0 (Default)

The pulse output resolution per revolution can be divided by any ratio according to the formula as follows.

Pulse output resolution per revolution=

$$\frac{\text{Pr4E(Numerator of pulse output division)}}{\text{Pr4F(Denominator of pulse output division)}} \text{ x encoder resolution per revolution}$$

Note:

• The encoder resolution is 10000 ppr for the 2500ppr incremental encoder.

• The pulse output resolution per revolution cannot be greater than the encoder resolution. (In the above setting, the pulse output resolution equals to the encoder resolution.)

• Z-phase is fed out once per revolution of the motor.

13.4.5 Parameters for velocity and torque control

Parameter No.(Pr□□)	Function	Pre-set Value	Range	Unit	Applicable Mode
50	Speed control input gain	500	10~2000	rpm/V	S，T
51	Speed control input reverse	1	0~1	-	S
52	Speed control offset	0	-2047~2047	0.3mV	S，T
53	First of speed setting	0	-10000~10000	rpm	S
54	Second of speed setting	0	-10000~10000	rpm	S
55	Third of speed setting	0	-10000~10000	rpm	S
56	Fourth of speed setting	0	-10000~10000	rpm	S，T
74	Fifth of speed setting	0	-10000~10000	rpm	S
75	Sixth of speed setting	0	-10000~10000	rpm	S
76	Seventh of speed setting	0	-10000~10000	rpm	S
77	Eighth of speed setting	0	-10000~10000	rpm	S
57	Jog speed setting	200	1~2000	rpm	All
58	Acceleration time setting	0	0~10000	1ms/(1000rpm)	S
59	Deceleration time setting	0	0~10000	1ms/(1000rpm)	S
5A	Sigmoid acceleration/ deceleration time setting	0	0~1000	2ms	S
5B	Torque command select	0	0~1	-	T
5C	Torque control input gain	30	10~100	0.1V/100%	T
5D	Torque control input reverse	0	0~1	-	T
5E	First torque limit setting	300	0~300	%	All
5F	Second torque limit setting	300	0~300	%	All

Pr50 Input gain of speed command

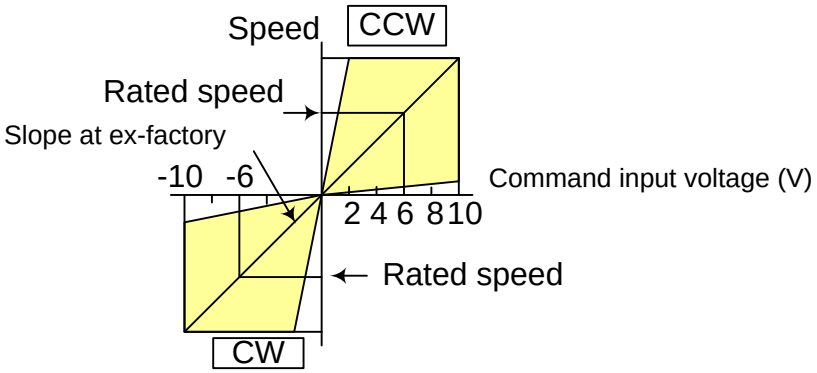
Initial Value：【500】

Setting Range：10~2000

Unit：rpm/V

Function：You can set up the relation between the voltage applied to the speed command input (SPR : CN I/F, Pin-14) and the motor speed.

- You can set up a "slope" of the relation between the command input voltage and the motor speed, with Pr50.
- Default is set to Pr50=500 rpm/V, hence input of 6V becomes 3000rpm.



Note:

1. Do not apply more than ±10V to the speed command input (SPR).
2. When you use the driver in velocity control mode and the whole system doing position control under position controller, the larger setting value of Pr50 gives larger variance to the overall servo system. (Normally, the position controller use 10V to rated speed) Pay an extra attention to oscillation caused by larger setting of Pr50.

Pr51 Reversal of speed command input

Initial Value：【1】

Setting Range：0~1

Unit：-

Function：You can reverse the polarity of the speed command input signal (SPR:CN I/F, Pin-14). Use this function when you want to change the motor rotational direction without changing the polarity of the command signal from the host.

Setting Value	Rotation Direction of Motor
0	CCW direction with (+) command (viewed from the motor shaft end)
1	CW direction with (+) command (viewed from the motor shaft end)

Note:

• Default of this parameter is 1, and the motor turns to CW with (+) signal.

• When Pr06 (ZEROSPD) is set to 2, this parameter becomes invalid.

Warning:

When you compose the servo drive system with this driver set to velocity control mode with external positioning controller, motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setting does not match.

Pr 52 Speed command offset

Initial Value：【0】

Setting Range：-2047~2047

Unit：0.3mV

Function：You can make an offset adjustment of analog speed command (SPR :CN I/F, Pin-14) with this parameter.

• The offset volume is 0.3mV per unit value of speed command offset.

• There are 2 offset methods, (1) Manual adjustment and (2) Automatic adjustment.

1) Manual adjustment

• When you make an offset adjustment with the driver alone, enter 0 V exactly to the speed command input (SPR/TRQR), (or connect to the signal ground), then set this parameter up so that the motor may not turn.

• when you compose a position loop with a host positioning controller, set this parameter up so that the deviation pulse may be reduced to 0 at the Servo-Lock status.

2) Automatic adjustment

• For the details of operation method at automatic offset adjustment mode, refer to 12.9 Automatic offset adjustment.

• Result after the execution of the automatic offset function will be reflected in this parameter, Pr52.

Pr53 1st speed of speed setting

Initial Value：【0】
Setting Range：-10000~10000
Unit：rpm
Function：When the internal speed setting is validated with parameter Pr05, "Switching of internal or external speed setting", you can set up 1st to 4th speed into Pr53 to 56, 5th to 8th speed into Pr74 to 77 in direct unit of [rpm]
In torque control mode, Pr56 becomes the speed limit.
Note:
• The polarity of the setting value represents that of the internal command speed.

＋	Command to CCW (viewed from the motor shaft end)
—	Command to CW (viewed from the motor shaft end)

Pr54 2nd speed of speed setting

Initial Value：【0】
Setting Range：-10000~10000
Unit：rpm
Function：Refer to Pr53

Pr55 3rd speed of speed setting

Initial Value：【0】
Setting Range：-10000~10000
Unit：rpm
Function：Refer to Pr53

Pr56 4th speed of speed setting

Initial Value：【0】
Setting Range：-10000~10000
Unit：rpm
Function：Refer to Pr53

Pr57 JOG speed setting

Initial Value：【200】
Setting Range：1~2000
Unit：rpm
Function：You can setting the JOG speed.
Refer to P53 12.7.1 Inspection Before Trial Run.

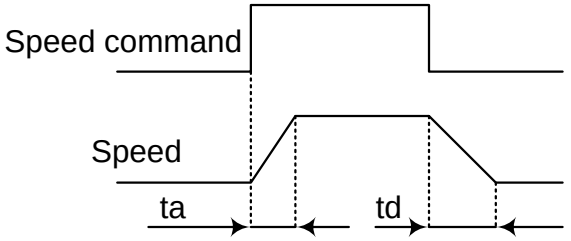
P58 Acceleration time setting

Initial Value：【0】

Setting Range：0~10000

Unit：1ms/ (1000rpm)

Function：You can make the velocity control while adding acceleration and deceleration command to the speed command inside of the driver. With this function, you can make a soft-start when you enter the step-speed command and when you use with the internal speed setting.



ta	*Pr58 x 1ms/1000rpm*
td	*Pr59 x 1ms/1000rpm*

Note:

When using external position controller, please set Pr58 and Pr59 to 0, the acceleration and deceleration control leave to the position controller.

Pr59 Deceleration time setting

Initial Value：【0】

Setting Range：0~10000

Unit：1ms/ (1000rpm)

Function：Refer to Pr58

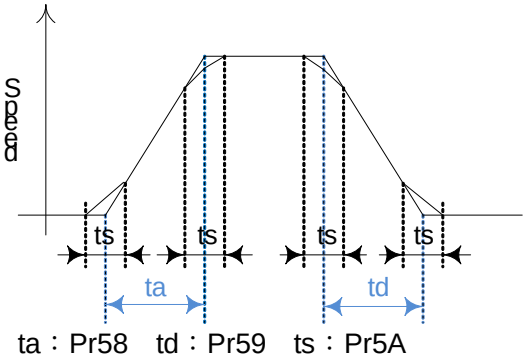
Pr5A S-curve acceleration/deceleration time setting

Initial Value：【0】

Setting Range：0~1000

Unit：2ms

Function：In order to obtain a smooth operation, you can set up the S-curve profile acceleration/deceleration to smooth to possible acceleration/deceleration shock of linear acceleration/deceleration profile.



1. Set up acceleration/deceleration for basic linear portion with Pr58 and Pr59
2. Set up S-curve time with time width centering the inflection point of linear acceleration/deceleration with Pr5A. (unit : 2ms)

Pr5B selection of torque command

Initial Value：【0】

Setting Range：0~1

Unit：－

Function：You can select the input of the torque command and the speed limit.

Pr5B	Torque command	Velocity limit
0	SPR/TRQR (CN I/F, Pin-14)	Pr56
1	CCWTL/TRQR (CN I/F, Pin-16)	SPR/TRQR (CN I/F, Pin-14)

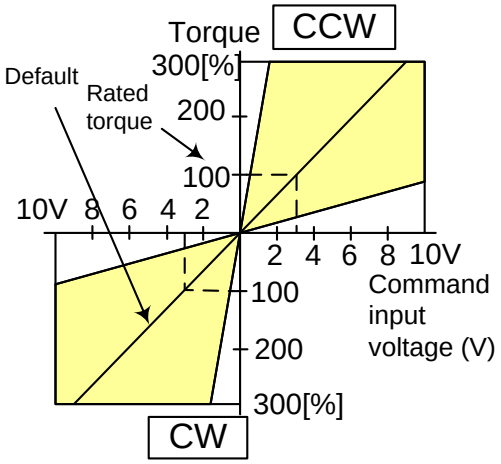
Pr5C Input gain of torque command

Initial Value：【30】

Setting Range：10~100

Unit：0.1V/100%

Function：You can set the relation between the voltage applied to the torque command input (SPR/TRQR : CN I/F, Pin-14 or CCWTL/TRQR : CN I/F, Pin-16) and the motor output torque.



• Unit of the setting value is [0.1V/100%] and set up input voltage necessary to produce the rated torque.

• Default setting of 30 represents 3V/100%.

Pr5D Input reversal of torque command

Initial Value：【0】

Setting Range：0~1

Unit：－

Function：You can reverse the polarity of the torque command input (SPR/TRQR : CN I/F, Pin-14 or CCWTL/TRQR : CN I/F, Pin-16)

Setting value	Direction of motor output torque
0	CCW direction (viewed from motor shaft) with (+) command
1	CW direction (viewed from motor shaft) with (+) command

Pr5E First torque limit setting

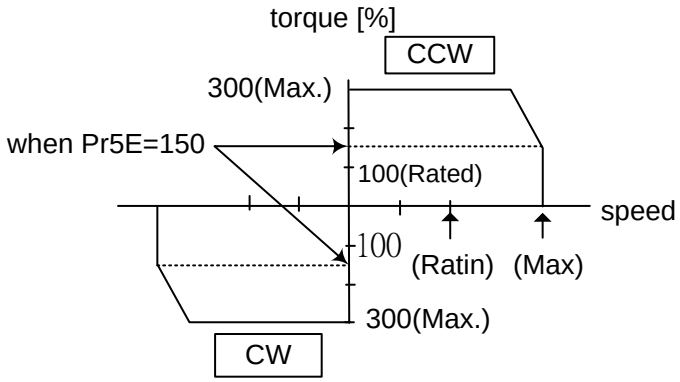
Initial Value：【300】

Setting Range：0~300

Unit：%

Function：When Pr03=1, this parameter is valid. You can limit the max torque for both CCW and CW direction with Pr5E.

This torque limit function limits the max. motor torque with the parameter setting. In normal operation, this driver permits approx. 3 times larger torque than the rated torque instantaneously. If this 3 times bigger torque causes any trouble to the load (machine), you can use this function to limit the max. torque.



• Setting value is to be given in % against the rated torque.
• shows example of 150% setting with Pr03=1.
• Pr5E limits the max. torque for both CCW and CW directions.

Pr5F Second torque limit setting

Initial Value：【300】

Setting Range：0~300

Unit：%

Function：Refer to Pr58. When Pr03=2, this parameter only limited CW torque.

13.5 Parameters for process

Parameter No.(Pr□□)	Function	Pre-set Value	Range	Unit	Applicable Mode
60	In-position range	10	0~32767	Pulse	P
61	Zero speed	50	10~10000	rpm	All
62	Speed arrival	1000	10~10000	rpm	S，T
63	Setting of excessive position deviation	20000	1~32000	Pulse	P
64	Invalid abnormality of excessive position deviation	0	0~1	-	P
65	In-position output setting	0	0~3	-	P
66	Sequence at driver inhibit input	0	0~1	-	All
67	Sequence at main power off	0	0~7	-	All
68	Sequence at alarm	0	0~3	-	All
69	Sequence at servo off	0	0~7	-	All
6A	Setting of mechanical brake action at stall	0	0~500	ms	All
6B	Setting of mechanical brake action at running	0	0~500	ms	All
★6C	Selection of external regenerative resistor	0	0~2	-	All

●Modification of parameter No. marked with ★ will be effective only after control power is reset.

Pr60 Positioning complete (in-position) range

Initial Value：【10】

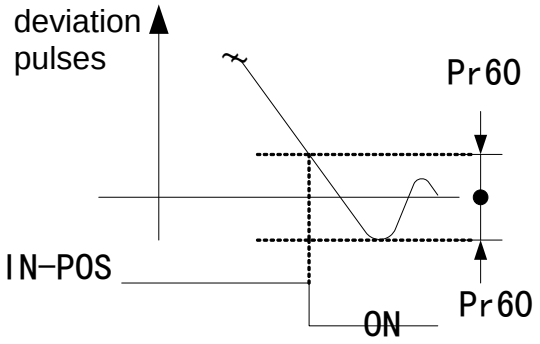
Setting Range：0~32767

Unit：Pulse

Function：You can set up the accuracy range to output the positioning complete signal(IN-POS : CN I/F, Pin-39).

The positioning complete signal (IN-POS) will be output when the deviation counter pulse counts fall within ± (the setting value), after the command pulse entry is completed.

• Basic unit of deviation pulse is encoder "resolution".



Note:

1. If you set too small value to Pr60, the time until the IN-POS signal is fed might become longer, or cause chattering at output.
2. The setting of "Positioning complete range" does not give any effect to the final positioning accuracy.

Pr61 Zero-speed

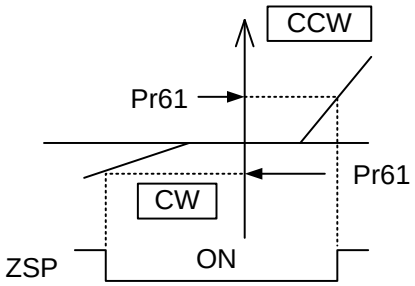
Initial Value：【50】

Setting Range：10~10000

Unit：rpm

Function：You can set the range to output the zero-speed output signal (ZSP : CN I/F, Pin-12 or TCL : CN I/F, Pin-40) in rotational speed [rpm].

The zero-speed detection signal (ZSP) will be output when the motor speed falls under the setting of this parameter, Pr61.



Pr62 At-speed (speed arrival)

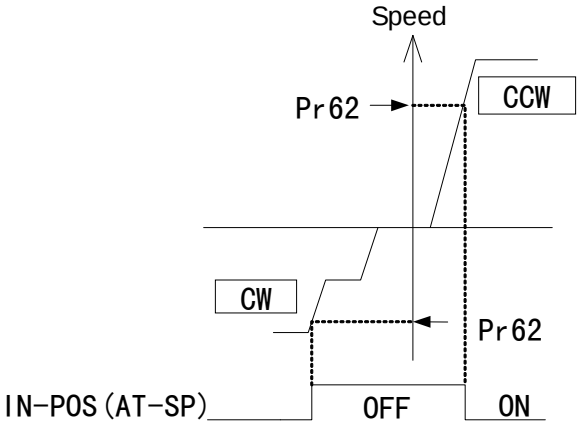
Initial Value：【1000】

Setting Range：10~10000

Unit：rpm

Function：You can set up speed limit to output the At-speed signal（AT-SP：CN I/F PIN 39）At-speed (Speed arrival) will be output when the motor speed exceeds the setting speed of Pr62.

The setting of Pr62 is valid for both CCW and CW direction regardless of the motor rotational direction.



Pr63 Setting of position deviation excess

Initial Value：【20000】

Setting Range：1~32000

Unit：Pulse

Function： You can set the excess range of position deviation.

Note:

If setting of position gain is too low and setting of Pr63 is too small, even the servo system is not in the abnormality state, position deviation excess protection may happen.

Pr64 Position deviation excess validity

Initial Value：【0】

Setting Range：0~1

Unit：－

Function：This parameter can make “position deviation excess” function invalid.

Setting Value	position deviation excess
0	Valid
1	Invalid. As detaining pulses is over the determinant level set by Pr63, it will not be treated as abnormality and continue action.

Pr65 Setting of positioning complete (IN-POS) output

Initial Value：【0】

Setting Range：0~3

Unit：–

Function：You can set the action of the positioning complete signal (IN-POS: CN I/F Pin-39) in combination with Pr60 (Positioning complete range).

Setting value	Action of positioning complete signal
0	The signal will turn on when the positional deviation is smaller than Pr60 (Positioning complete range)
1	The signal will turn on when there is no position command and the positional deviation is smaller than Pr60 (Positioning complete range).
2	The signal will turn on when there is no position command, the zero-speed detection signal is ON and the positional deviation is smaller than Pr60 (Positioning complete range).
3	The signal will turn on when there is no position command and the positional deviation is smaller than Pr60 (Positioning complete range).Then holds "ON" status until the next position command is entered.

Pr66 Sequence at over-travel protection occurrence

Initial Value：【0】

Setting Range：0~1

Unit：–

Function：You can set the running condition during deceleration or after stalling while over-travel inhibit input （CCW-LIMIT：CN I/F PIN 9 or CW-LIMIT：CN I/F PIN 8）is valid.

Setting Value	Drive Condition		Deviation counter content
	During deceleration	After stalling	
0	Dynamic Brake	Free-run	Hold
1	Free-run	Free-run	Hold

Pr67 Sequence at main power OFF occurrence

Initial Value：【0】

Setting Range：0~7

Unit：–

Function：Refer Pr69

Pr68 Sequence at alarm occurrence

Initial Value：【0】

Setting Range：0~3

Unit：–

Function：You can set up the action during deceleration or after stalling when some error occurs while either one of the protective functions of the driver is triggered.

Setting value	Drive Condition		Deviation counter content
	During deceleration	After stalling	
0	Dynamic Brake	Dynamic Brake	Clear
1	Free-run	Dynamic Brake	Clear
2	Dynamic Brake	Free-run	Clear
3	Free-run	Free-run	Clear

Note:

The content of the deviation counter will be cleared when clearing the alarm. Refer to "Timing Chart (When an error (alarm) occurs at Servo-ON command status)" of Preparation.

Pr69 Sequence at servo OFF occurrence

Initial Value：【0】

Setting Range：0~7

Unit：–

Function：When Pr65 (LV trip selection at main power OFF) is 0, you can set up.

1) the action during deceleration and after stalling

2) the clearing of deviation counter after the main power is shut off.

Setting value	Drive Condition		Deviation counter content
	During deceleration	After stalling	
0	Dynamic Brake	Dynamic Brake	Clear
1	Free-run	Dynamic Brake	Clear
2	Dynamic Brake	Free-run	Clear
3	Free-run	Free-run	Clear
4	Dynamic Brake	Dynamic Brake	Hold
5	Free-run	Dynamic Brake	Hold
6	Dynamic Brake	Free-run	Hold
7	Free-run	Free-run	Hold

Pr6A Setting of delay time from servo off to motor non-energized (motor at stall)

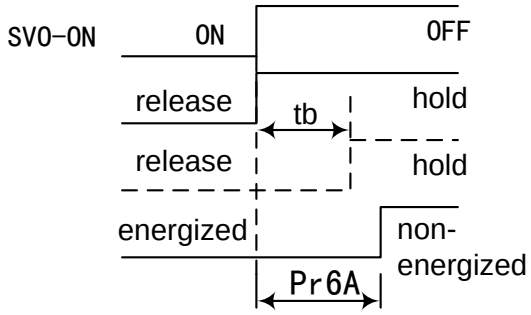
Initial Value：【0】

Setting Range：0~200

Unit：ms

Function：Setup the time from switch off SERVO-ON signal (BRK-OFF : CN I/F, Pin-10 and 11) to motor non-energized while motor at stall.

- Set up to prevent a micro-travel/drop of the motor (work) due to the action delay time (tb) of the brake.
- After setting up Pr6A >=tb then the driver will de-energize the motor after the brake is actually activated.



Refer to "Timing Chart"-Servo-ON/OFF Action While the Motor Is at Stall" of Preparation as well.

P6B Setting of delay time from servo-off to brake hold (motor at running)

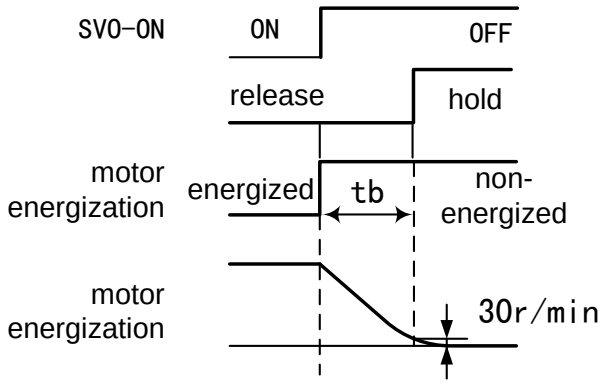
Initial Value：【0】

Setting Range：0~200

Unit：ms

Function：Setup the time from switch off Servo-ON input signal (SRV-ON : CN I/F, Pin-29) to external brake release signal output(BRK-OFF : CN I/F, Pin-10 and 11) turns off while motor at running.

- Set up to prevent the brake deterioration due to the motor running.
- At switch off Servo-ON during the motor is running, tb (refer the following fig.) will be the shorter one of either Pr6B setting time, or time lapse from SERVO-ON switch off to motor speed falls below 30rpm.



Refer to "Timing Chart"-Servo-ON/OFF action while the motor is in motion" of Preparation as well.

Pr6C ★Selection of external regeneration resistor

Initial Value：【0】

Setting Range：0~2

Unit：–

Function：With this parameter, you can select either to use the built-in regeneration resistor of the driver, or to disable built-in regeneration resistor and use external installed regeneration resistor (between P1 and B2) to consume the regeneration energy.

Setting value	Regeneration resistor to be used	Regeneration processing and regeneration resistor overload
0	Built-in resistor	Use internal resistor to consume regeneration energy. Regeneration overload protection act.
1	External resistor	Use external installed resistor to consume regeneration energy on 10% work duty. Regeneration overload protection act.
2	External resistor	No protection

Pr74 5th speed of speed setting

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr75 6th speed of speed setting

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr76 7th speed of speed setting

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr77 8th speed of speed setting

Initial Value：【0】

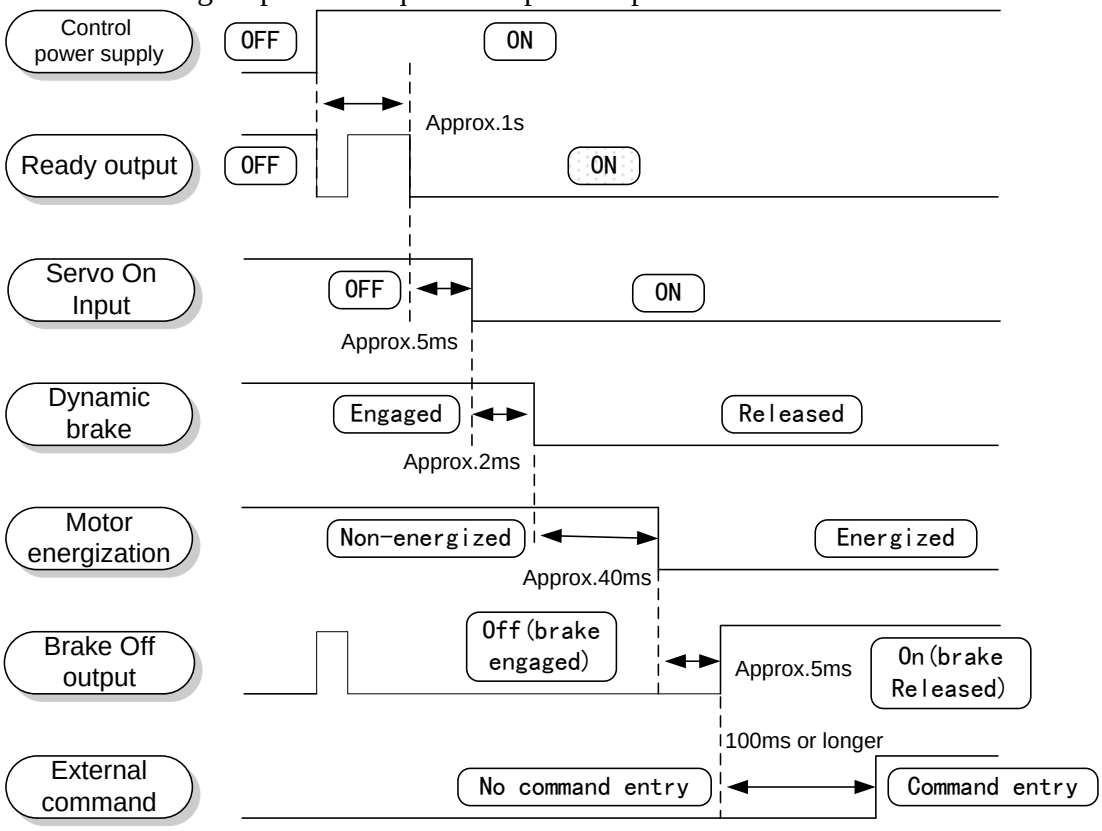
Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

14. Control Sequence Timing Chart

14.1 Servo ON signal process sequence as power-up

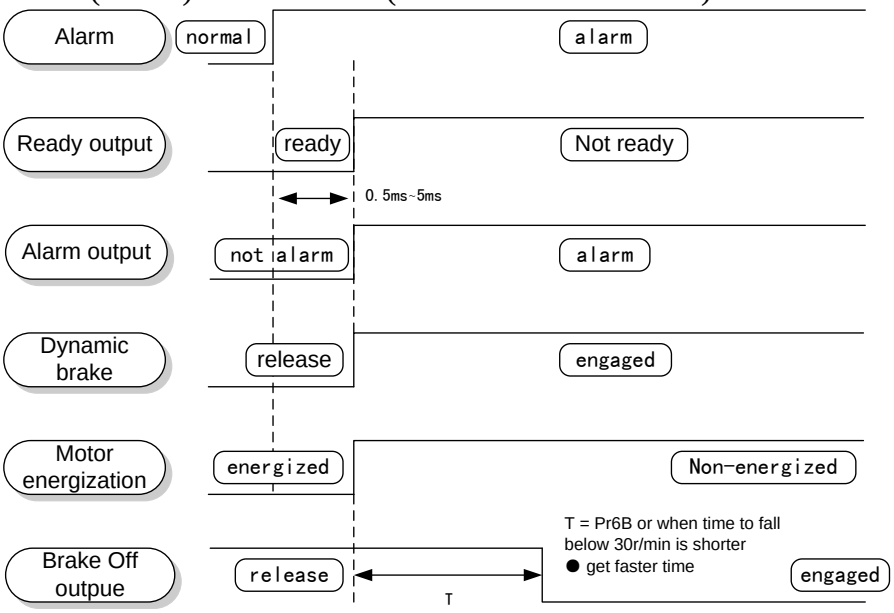


Notes:

a. Above charter represents the sequences from AC power start to order input.

b. Input Servo ON signal and external commands according to above sequences.

14.2 When an Error (Alarm) Has Occurred (at Servo-ON Command)

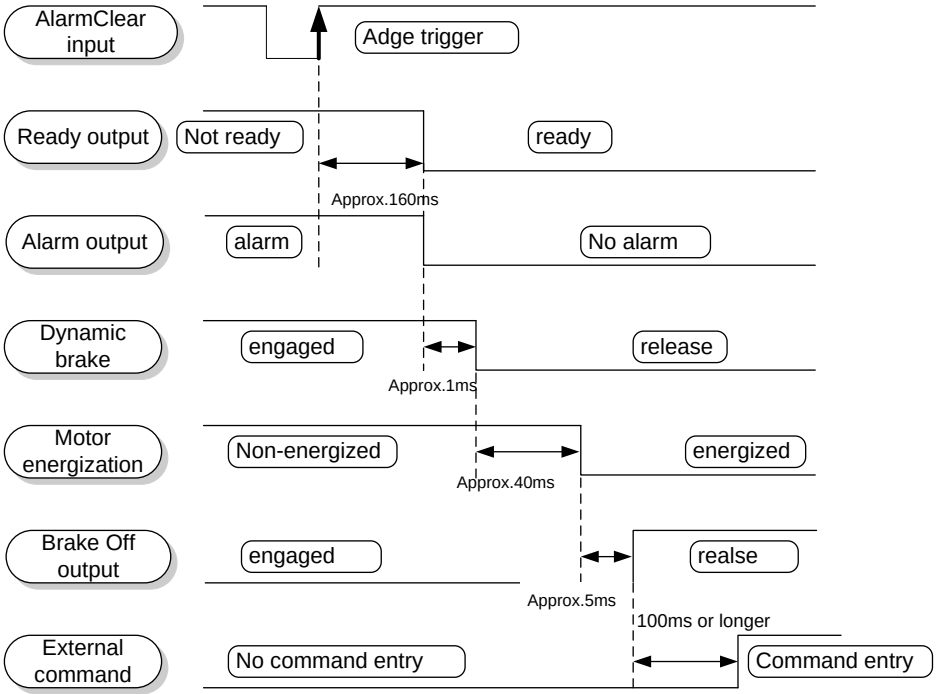


Related parameter:
Pr68 Sequence at alarm
Pr6B Setup of mechanical brake action at running

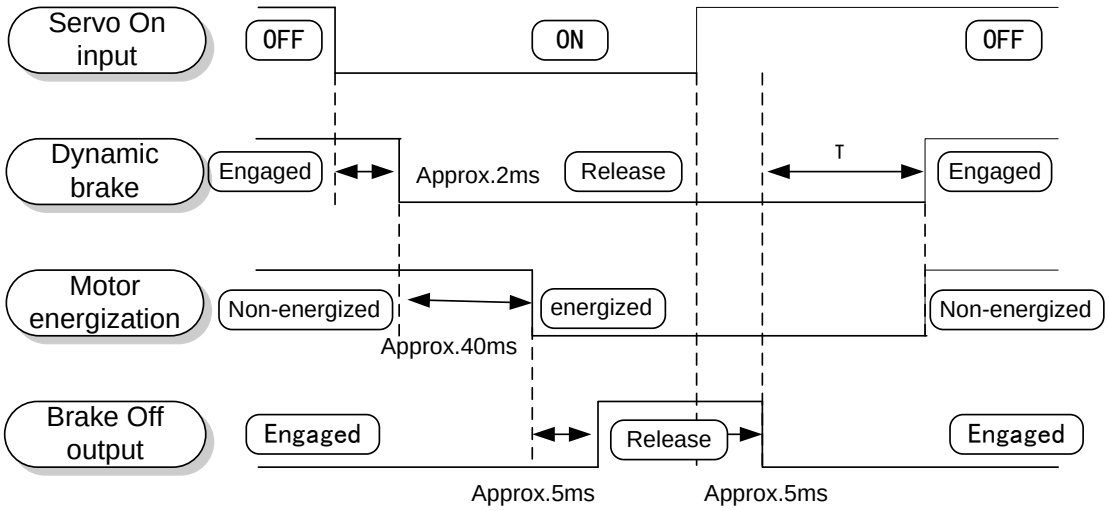
Note:

1. T will be a shorter time of either the setup value of Pr6B or elapsing time for the motor speed to fall below 30r/min. T will be 0 when the motor is in stall regardless of the setup of Pr6A.
2. For the action of dynamic brake at alarm occurrence, refer to an explanation of Pr68, "Sequence at alarm ("Parameter setup" at each control mode) as well.

14.3 When an Alarm Has Been Cleared (at Servo-ON Command)



14.4 Servo-ON/OFF Action While the Motor Is at Stall (Servo-Lock)



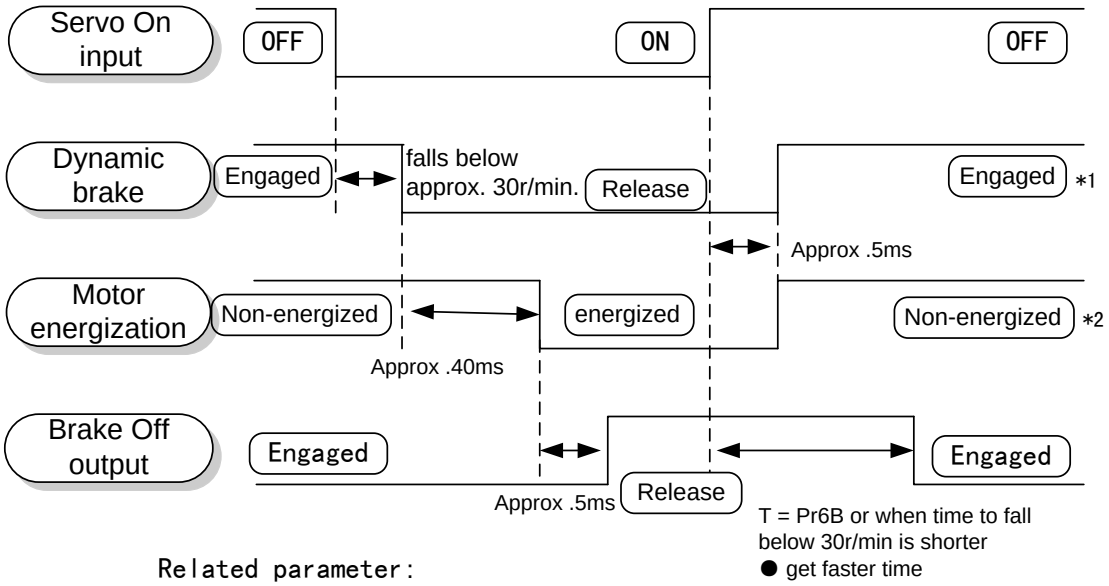
Related parameter:
Pr69 Sequence at main power OFF
Pr6A Setup of mechanical brake action at stalling

Notes:

1. T will be determined by Pr6A setup value.
2. For the dynamic brake action at Servo-OFF, refer to an explanation of Pr69, "Sequence at Servo-OFF ("Parameter setup" at each control mode) as well.
3. Servo-ON will not be activated until the motor speed falls below approx. 30r/min.

14.5 Servo-ON/OFF Action While the Motor Is in Motion

(Timing at emergency stop or over trip only. Do not repeat this sequence at normal operation. During the normal operation, stop the motor first then make Servo-ON/OFF action.)



Related parameter:

Pr69 Sequence at main power OFF

Pr6B Setup of mechanical brake action at running

Notes:

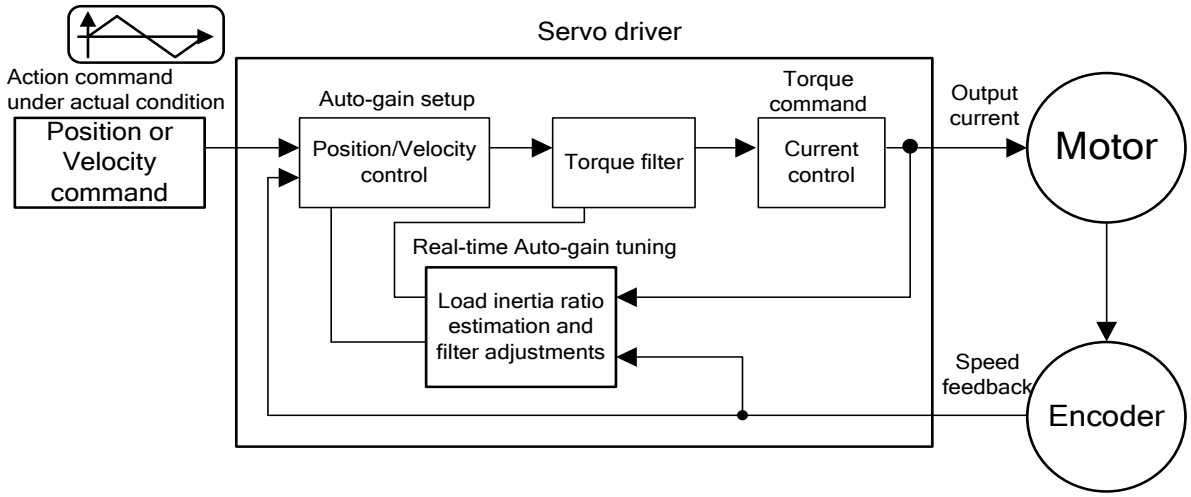
1. T will be a shorter time of either the setup value of Pr6B or elapsing time for the motor speed to fall below 30r/min.
2. Even though the SRV-ON signal is turned on again during the motor deceleration, Servo-ON will not be activated until the motor stops.
3. Servo-ON will not be activated until the motor speed falls below approx. 30r/min.
   *1*2 For the motor energized during deceleration at Servo-OFF, refer to an explanation of Pr69, "Sequence at Serve-OFF ("Parameter setup" at each control mode) as well.

15. Gain adjustment and speed limit

15.1 Real-time Auto-gain adjustment

The driver estimates the load inertia of the machine in real time, and automatically sets up the optimum gain responding to the result. Also the driver automatically suppresses the vibration caused by the resonance with an adaptive filter.

All drive control mode, can utilize the real-time auto-gain adjustment.



Methods of operation

1. Bring the motor to stall (Servo-OFF). (SVO-ON：CN I/F PIN 29)
2. Set up Pr21(Real-time auto-gain)，Set to a value other than 0. Usually begins from a number set by the small. The smaller the value, representing the learning rate is lower, for moderate changes in load inertia body. Higher learning rate, although you can quickly estimate the change in inertia, but because some motion curve may become unstable.
3. Pr22 set stiffness parameters, please start from the lower value set.
4. Then the motor can be Servo ON, that is, the input signal (SVO-ON: CN I / F PIN 29) to ON, and operation of machinery in accordance with the general way to start.
5. In the mechanical operation, please also observe whether the normal functioning of institutions. When you want to improve the motor response, gradually increase the value of Pr22 to the appropriate stiffness. Adjust stiffness, if the occurrence of abnormal noise or mechanical earthquake, they should immediately reduce the stiffness values
6. Operation is completed; the results can be saved to EEPROM, for later re-use.

Setting Value	Real-time auto-gain	Load inertia
【0】	Turn off	
1	Slower learning rate	Almost no change
2		
3	Normal learning rate	Change mitigation
4		
5		
6	Fast learning rate	Fast changes
7		

Note:

1. Setting is "0", it will turn off real-time auto-gain adjustment function.
2. The following conditions occurs, real-time auto-gain adjustment may not work, use off-line auto-gain or manually adjust the gain of the gain adjustment parameters.
   - Rapid changes in load inertia ratio.
   - Load inertia is too large, more than 20 times
   - Mechanical stiffness is too low
   - Gear gap phenomenon occurs

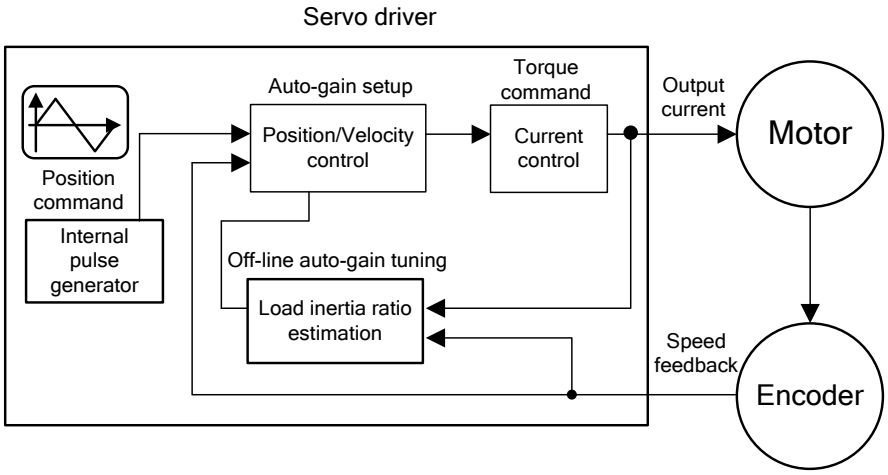
Automatic adjusted parameter list

On-line real-time auto-gain function is turned on, the following parameters will be automatically adjusted, but can not manually change the value.

Pr No.	Function
10	First position loop gain
11	First speed loop gain
12	Time constant of first speed loop integral
13	First speed detection filter
14	Time constant of first torque filter
15	Speed feed-forward
16	Time constant of speed feed-forward filter
18	Second position loop gain
19	Second speed loop gain
1A	Time constant of second speed loop integral
1B	Second speed detection filter
1C	Time constant of second torque filter
20	Inertia ratio
30	Second gain action setting

15.2 Off-line Auto-gain adjustment

The drive use internal position command to control motor movements. It runs through the mechanical load torque and acceleration then estimate the load inertia ratio to automatically adjust to the appropriate gain.



Methods of operation

1. Please be in accordance with the machinery of the actual situation, setting Pr25(off-line auto-gain). Select the mode of operation and scope rotated.
   Pr25 = 0, meaning the motor (facing shaft) from the starting point, first to the CCW direction of rotation 2 laps later, and then went to the CW direction of rotation 2 laps back to the original starting point, execution totally five cycles.
2. According to the set value of scope rotated, the mechanical load will be safe in operation and be sure to disable all external command input to drive.
3. Motor Servo ON, that is, the input signal (SVO-ON: CN I / F PIN 29) is turned ON.
4. Choose the mechanical stiffness values required. You can start the off-line auto-gain adjustment, stiffness value setting, please begin by smaller setting value. If the mechanical function is normal, and then increase to the appropriate stiffness values, adjusted to no abnormal noise or vibration.
5. Operation is completed; the results can be saved to EEPROM, for later re-use.

Note:

If the following conditions occur, off-line auto-gain adjustment may not work, use manually adjust of the gain adjustment parameters.

- Load inertia is too large, more than 20 times
- Mechanical stiffness is too low
- Gear gap phenomenon occurs

Setting Value	Rotational direction	Number of revolution
【0】	CCW → CW	2 revolution(CCW → CW)
1	CW → CCW	2 revolution(CW → CCW)
2	CCW →	2 revolution(only CCW)
3	CW →	2 revolution(only CW)
4	CCW → CW	1 revolution(CCW → CW)
5	CW → CCW	1 revolution(CW → CCW)
6	CCW →	1 revolution(only CCW)
7	CW →	1 revolution(only CW)

Automatic adjusted parameter list

If off-line auto-gain function is turned on, the following parameters will be automatically adjusted.

		stiffness															
Pr No	Function	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10	First position loop gain	12	20	31	40	47	59	63	70	75	82	95	115	132	164	195	255
11	First speed loop gain	9	15	19	25	36	43	50	59	65	72	85	104	126	155	185	240
12	Time constant of first speed loop integral	62	50	38	31	28	26	24	22	21	19	18	17	16	15	15	9
13	First speed detection filter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Time constant of first torque filter	500	500	500	500	500	350	300	250	250	200	150	150	150	150	150	150
15	Speed feed-forward	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
16	Time constant of speed feed-forward filter	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
18	Second position loop gain	19	24	37	48	54	69	74	82	87	95	111	134	154	191	228	297
19	Second speed loop gain	9	15	19	25	36	43	50	59	65	72	85	104	126	155	185	240
1A	Time constant of second speed loop integral	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
1B	Second speed detection filter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1C	Time constant of second torque filter	500	500	500	500	500	350	300	250	250	200	150	150	150	150	150	150
20	Inertia ratio																
31	Position control shift mode	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
32	Position control shift delay time	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
33	Position control shift level	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
34	Position control shift width	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
35	Position gain shift time	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
36	Speed control shift mode	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3A	Torque control shift mode	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

15.3 Manual Adjustment of gain

15.3.1 Adjustment in Position Control Mode

Order	Parameter No.	Title of parameter	Standard value	How to adjust
1	Pr11	1st gain of velocity loop	36	Increase the value within the range where no abnormal noise and no vibration occur. If they occur, lower the value.
2	Pr14	1st time constant of torque filter	65	When vibration occurs by changing Pr11, change this value. Setup so as to make Pr11 x Pr14 becomes smaller than 10000. If you want to suppress vibration at stopping, setup larger value to Pr14 and smaller value to Pr11. If you experience too large vibration right before stopping, lower the value of Pr14.
3	Pr10	1st gain of position loop	47	Adjust this observing the positioning time. Larger the setup, faster the positioning time you can obtain, but too large setup may cause oscillation.
4	Pr12	1st time constant of velocity loop integration	28	Setup this value within the range where no problem occurs. If you setup smaller value, you can obtain a shorter positioning time, but too small value may cause oscillation. If you setup too large value, deviation pulses do not converge and will be remained.
5	Pr15	Velocity feed forward	300	Increase the value within the range where no abnormal noise occurs. Too large setup may result in overshoot or chattering of position complete signal, hence does not shorten the settling time. If the command pulse is not evenly distributed, you can improve by setting up Pr16 (Feed forward filter) to larger value.

15.3.2 Adjustment in Velocity Control Mode

Except gain of position loop and Velocity feed forward, adjustments of velocity control are similar with above adjustment of position mode.

15.3.3 Adjustment in Torque Control Mode

Pr56 (4th speed of speed setting)or velocity control loop of SPR speed limit input is the base of torque control. The following explains the setting of speed limit value.

15.4 Setup of speed limit

The Pr56 4th speed setting will transfer its function to speed limit under:

1. the torque command selection Pr5B=0 and use torque command input mode or
2. the torque command selection Pr5B=1 and use analog speed command input mode

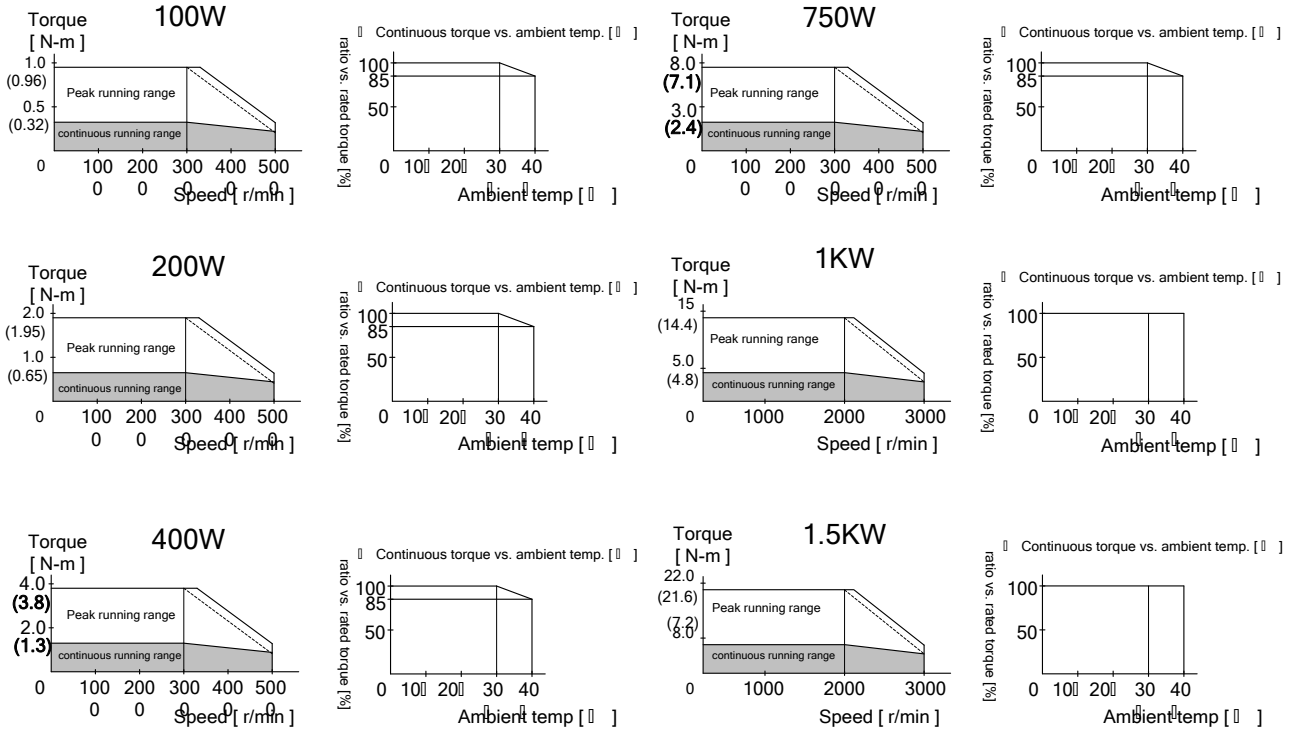
Under condition 1, when the motor speed approaches to the speed limiting value, torque control following the analog torque command will shift to velocity control based on the speed limiting value which will be determined by the 4th speed of speed setup (Pr56) or the analog speed command input (SPR/TRQR/SPL).

In order to stabilize the movement under the speed limiting, you are required to set up the parameters according to the above-mentioned "Adjustment in Velocity Control Mode".

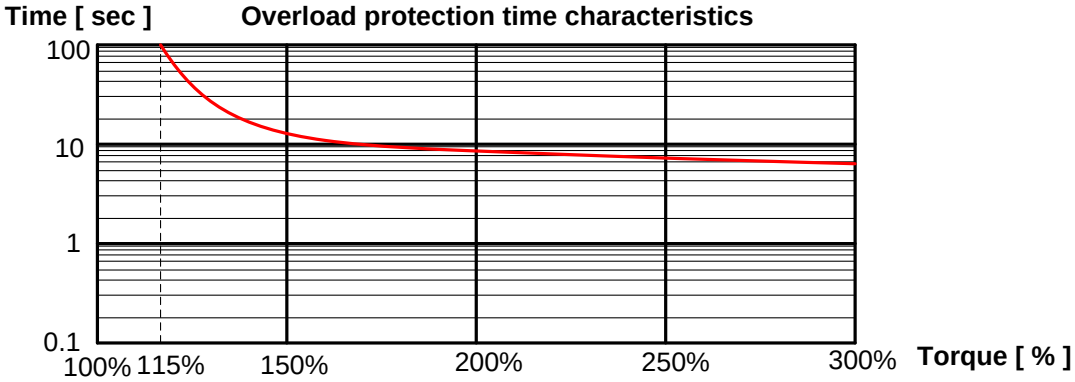
When the speed limiting value = 4th speed of speed setup (Pr56) , the analog speed command input is too low or the velocity loop gain is too low, or when the time constant of the velocity loop integration is 1000 (invalid), the input to the torque limiting portion of the above fig. becomes small and the output torque may not be generated as the analog torque command.

16. Motor Characteristics (S-T Characteristics)

16.1 Motor characteristic curve



16.2 Overload protection time characteristics



17. Connector Kit for Motor/Encoder Connection

17.1 Connector and connector pin

Applicable motor models：KSMA 100W ~ 750W

Item	Part No.	Number	Manufacturer	Note
Connector	172167-1	1	Tyco electronics	connector of motor side and power connection
Connector pin	170364-1	4	Tyco electronics	
Connector	172171-1	1	Tyco electronics	connector of motor side and encoder connection
Connector pin	170363-1	11	Tyco electronics	
Connector	172159-1	1	Tyco electronics	connector of motor power connection cable
Connector pin	170366-1	4	Tyco electronics	
Connector	172163-1	1	Tyco electronics	connector of encoder connection cable
Connector pin	170365-1	11	Tyco electronics	

Applicable motor models：KSMA 1000W ~ 2000W

Item	Part No.	Number	Manufacturer	Note
Straight connector	AMS3106B 20-4S	1	PLT	connector of motor power connection cable
90 degree connector	AMS3108B 20-4S	1	PLT	
Straight connector	AMS3106B 20-29S	1	PLT	connector of encoder connection cable
90 degree connector	AMS3108B 20-29S	1	PLT	

※Above non-waterproof models, if the waterproof requirements, please purchase separately.

17.2 SCSI-II Interface Cable

Connector of diver side	Related connector prepard by user		Manufacturer
	Part No.	Type	
SIG	Connector(Welded)	10120-3000PE	Sumitomo 3M
	Shell of Connector	10320-52A0-008	
I/F	Connector(Welded)	10150-3000PE	Sumitomo 3M
	Shell of Connector	10350-52A0-008	

17.3 Specification of Main Loop connector

Item	Part No.	Number	Manufacturer	Note
Connector (Female), 5PIN，7.5mm	231-205/026-000	1	WAGO	connector used by main power(L1,L2, L3)and control power(r, t)
Connector (Female), 3PIN，5mm	231-103/026-000	1	WAGO	Connectors of flyback resistor (P, B1, B2)
Connetctor (Female), 3PIN，7.5mm	231-203/026-000	1	WAGO	Connector of motor power(U、V、V)
White lever	231-131	2	WAGO	Wiring tool

18. Driver Specifications

18.1 Basic Specifications

Basic Specifications	Input power	Main circuit	Single/3-phase，190~255V 50/60Hz
		Control circuit	Single Phase，190~255V 50/60Hz
	Environment	Temperature	Operating : 0 to 55℃, Storage : –20 to +80℃
		Humidity	Both operating and storage : 90%RH or less (free from condensation)
		Altitude	1000m or lower
		Vibration	5.88m/s2 or less, 10 to 60Hz (No continuous use at resonance frequency)
	Control method		IGBT PWM Sinusoidal wave drive
	Encoder feedback		2500P/r (10000 resolution) incremental encoder
	Control signal	Input	11 inputs (1) Servo-ON, (2) Control mode switching, (3) Gain switching/Torque limit switching, (4) Alarm clear Other inputs vary depending on the control mode.
		Output	6 outputs (1) Servo alarm, (2) Servo ready, (3) Release signal of external brake (4) Zero speed detection,(5) Torque in-limit. Other outputs vary depending on the control mode.
	Analog signal	Input	3 inputs(A/D)
		Output	2 outputs (for monitoring) (1) Velocity monitor (Monitoring of actual motor speed or command speed is enabled. Select the content and scale with parameter.), (2) Torque monitor (Monitoring of torque command,(approx.. 3V/rated torque)), deviation counter or full-closed deviation is enabled. Select the content or scale with parameter.)
	Pulse signal	Input	4 inputs ,Select the exclusive input for line driver or photo-coupler input with parameter.
		Output	4 outputs ,Feed out the encoder pulse (A, B and Z-phase) or external scale pulse (EXA, EXB and EXZ-phase) in line driver. Z-phase and EXZ-phase pulse is also fed out in open collector.
	Communication function	RS232	1 : 1 communication to a host with RS23 interface is enabled.
	Front panel		(1) 5 keys (MODE, SET, UP, DOWN, SHIFT), (2) LED (6-digit)
	Regeneration		Built-in regenerative resistor (50W) ◦
	Dynamic brake		Setup of action sequence at Power-OFF, Servo-OFF, at protective function activation and over-travel inhibit input is enabled.
	Control mode		Switching among the following 6 mode is enabled, (1) Position control, (2) Velocity control, (3) Toque control, (4) Position/Velocity control, (5) Position/Torque control, (6) Velocity/Torque control

18.2 Function

Function	Control input			Inputs of 1) Servo-ON, 2) Alarm clear, 3) Gain switching, 4) Control mode switching, 5) CW over-travel inhibition and 6) CCW over-travel inhibition are common, and other inputs vary depending on the control mode.
	Position	Control input		(1) Deviation counter clear, (2) Command pulse inhibition, (3) Damping control switching,(4) Gain switching or Torque limit switching
		Control output		Positioning complete (In-position)
		Pulse input	Max. command pulse frequency	Exclusive interface for line driver : 2Mpps, Line driver : 500kpps, Open collector : 200kpps
			Input pulse signal format	Support (1) RS422 line drive signal and (2) Open collector signal from controller.
			Type of input pulse	1) CW/CCW pulse, (2) Pulse signal/rotational direction signal, (3) 90° phase difference signal
			Electronic gear (Division/ Multiplication of command pulse)	Process the command pulse frequency $\times \frac{(1 \text{ to } 10000) \times 2^{(0 \text{ to } 17)}}{1 \text{ to } 10000}$
			Smoothing filter	Primary delay filter is adaptable to the command input Selectable of (1) Position control for high stiffness machine and (2) FIR type filter for position control for low stiffness machine.
		Analog input	Torque limit command input	Individual torque limit for both CW and CCW direction is enabled. (3V/rated torque)
	Velocity	Control input		(1) Speed zero clamp, (2) Selection of internal velocity setup, (3) Gain switching or Torque limit switching input
		Control output		(1) Speed arrival (at-speed)
		Analog input	Velocity command input	Setup of scale and rotational direction of the motor against the command voltage is enabled with parameter, with the permissible max. voltage input = ±10V and 6V/rated speed (default setup)
			Torque limit command input	Individual torque limit for both CW and CCW direction is enabled. (3V/rated torque)
		Speed control range		1：5000
		Internal velocity command		8-speed with parameter setup
		Soft-start/down function		Individual setup of acceleration and deceleration is enabled, with 0 to 10s/1000r/min. Sigmoid acceleration/deceleration is also enabled.
		Zero-speed clam		0-clamp of internal velocity command with speed zero clamp input is enabled.

Function	Torque control	Control input		(1) CW over-travel inhibition, (2) CCW over-travel inhibition, (3) Speed zero clamp
		Control output		(1) Speed arrival (at-speed)
		Analog input	Velocity Command input	Setup of scale and CW/CCW torque generating direction of the motor against the command voltage is enabled with parameter, with the permissible max. voltage input = ±10V and 3V/rated speed (default setup).
			Speed limit input	Speed limit input by analog voltage is enabled. Scale setup with parameter.
		Speed limit function		Speed limit value with parameter or analog input is enabled.
	Common	Masking of unnecessary input		Masking of the following input signal is enabled. (1) Over-travel inhibition, (2) Torque limit, (3) Command pulse inhibition, (4) Speed-zero clamp
		Division of encoder feedback pulse		Set up of any value is enabled (encoder pulses count is the max.).
		Protective function	Soft error	Over-voltage, under-voltage, over-speed over-load, over-heat, over-current and encoder error etc.
			Hard error	Excess position deviation, command pulse division error, EEPROM error etc.
		Traceability of alarm data		Traceable up to past 16 alarms including the present one.
		Setup	Manual	5push switches on front panel MODE SET △ ▽ ◁
			Setup support software	KSDTools

19. Error Code Description

Err.11 Under-voltage protection for control power

Causes

- Control power (r、t) lower voltage.
- Momentary power failure occur the input control voltage.
- Insufficient power, result in the instant voltage drop on.

Solution

- ✓ Measurement control power (r, t) of the input voltage is correct.
- ✓ Increase the capacity of power supply.

Err.12 Over-voltage protection

Causes

- Voltage exceeds permissible voltage range AC 260V.
- Regenerative resistor inappropriate, regenerative energy absorption is not complete.
- Regenerative resistor disconnected.

Solution

- ✓ Measurement main power (L1、L2、L3) of the input voltage is correct.
- ✓ Replaced by high power regenerative resistor.
- ✓ Measured P-B2 regenerative resistor values. If an open circuit, then replace the external resistor.

Err.13 Under-voltage protection for main power

Causes

- Main power (L1、L2、L3) low voltage.
- Main power Instant power failure.
- Insufficient power, result in the instant voltage drop on.
- Lack of power phase.

Solution

- ✓ Measurement main power (L1、L2、L3) of the input voltage is correct.
- ✓ Increase the capacity of power supply.
- ✓ Properly connected to the main power. When using single-phase power connection L1, L3. When using the three-phase power, connect L1, L2, L3.

Err.11 Over-current protection (software)

Causes

- Driver output current exceeds the limit values.
- Servo motor power line contact is not completely, UVW between the short circuit or ground.
- Command input and Servo ON the same time or earlier.
- Driver failure or motor failure.
- Often in the servo motor rotates, turn on or turn off the Servo ON, leading to destruction of the dynamic brake relay.
- Servo motor and drive specifications do not meet.

Solution

- ✓ Check servo motor UVW connector for loose or exposed wire and short circuit, poor insulation and green lines.
- ✓ Servo ON after waiting for more than 100ms is required, before they can input command.
- ✓ Please remove the servo motor power cable, then input the Servo ON test. If an exception occurs immediately after Servo ON, necessary to replace the drive.
- ✓ Measure the line resistance servo motor is balanced, if the resistance of imbalance need to replace the servo motor.
- ✓ Do not use Servo OFF / ON control servo motor to stop or running.
- ✓ According to label instructions, to confirm the servo motor drive models and capacities are matched with each other.

Err.15 Over-heat protection

Causes

- ● Driver cooling, power components over the temperature exceeded the specified value.
- ● Load excessive.

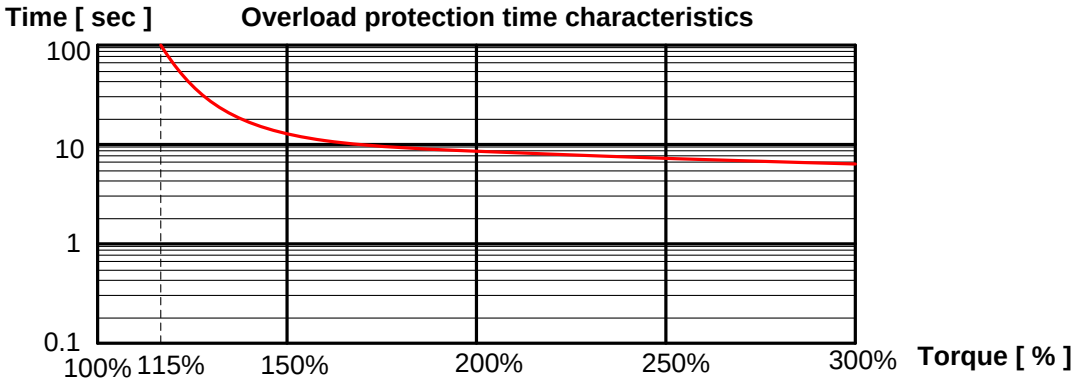
Solution

- ✓ Reduce the temperature of the environment and enhance DRIVER cooling.
- ✓ Increase the deceleration time and lower operating speed.
- ✓ Choose a higher capacity drives and servo motors.

Err.16 Overload protection

Causes

- ● Torque command values exceeded overload level (115%), the time limit will be based on overload characteristic curve, resulting in overload protection.



- ● Heavy load and makes the actual output torque exceeds the rated torque and continuous operation.
- ● Gain is adjusted properly, leading to mechanical vibration, shaking.
- ● Poor installation, cause the machine is not running smoothly.
- ● Motor operation, electromagnetic brake not released.

Solution

- ✓ Choose a higher capacity drives and servo motors.
- ✓ Increase the deceleration time and lower operating speed.
- ✓ Reduce the load.
- ✓ Re-adjust the gain parameter.
- ✓ Adjust machine so that machine running smoothly.
- ✓ Sure the electromagnetic brake of the terminal voltage (24V) is the normal brake release.

Err.18 Over regenerative load protection

Causes

- Large load, the servo motor in the regenerative energy during deceleration, regenerative resistor exceeded the processing capacity, resulting in increased driver of the capacitor voltage.
- Servo motor in high speed operation, in a short deceleration time can not fully absorb the regenerative energy.
- External resistor consumption is limited to 10% duty.

Solution

- ✓ Observing the driver alert status and regenerative load ratio.
- ✓ Increase the deceleration time and lower operating speed.
- ✓ Choose a higher capacity drives and servo motors
- ✓ Use of external regenerative resistor. (Specifications for the built-in regenerative resistor 150Ω 50W).
- ✓ After using the external regenerative resistor, if still not fully absorb the regenerative energy，You can try to Pr6C = 2，And note that using this setting, be sure to set the temperature fuse protection to avoid damage resistance.

Err.20 Encoder A,B phase error protection

Causes

- Encoder cable poor contact occurs, leading to A, B phase feedback signal or the differential voltage level is not correct.

Solution

- ✓ Check SIG encoder connector is properly connected driver.
- ✓ Check the encoder cable, male and female connectors really connected whether loose or loose metal pin.

Err.21 Encoder communication error protection

Causes

- Drive operation, to detect the driver and encoder communications interrupt too many times.

Solution

- ✓ Check SIG encoder connector is properly connected driver.
- ✓ Check the encoder cable, male and female connectors really connected whether loose or loose metal pin.
- ✓ encoder cable, motor cable, the power input line to keep their distance more than 30cm, please do not tie together by the same groove.

Err.22 encoder communication data error protection

Causes

- Drive operation, no breakdown in communications, but may be due to noise interference, and to detect the communication with the encoder information is incorrect.

Solution

- ✓ Check SIG encoder connector is properly connected driver.
- ✓ Check the encoder cable, male and female connectors really connected whether loose or loose metal pin.
- ✓ encoder cable, motor cable, the power input line to keep their distance more than 30cm, please do not tie together by the same groove.

Err.24 Excess position deviation protection

Causes

- Servo motor does not rotate to follow the command.
- Pulse position deviation exceeds Pr63.

Solution

- ✓ Check the servo motor to follow the position command input rotation.
- ✓ Check the servo motor wiring is correct UVW.
- ✓ Increase the gain setting.
- ✓ Extend motion controller acceleration and deceleration time and lower operating speed.
- ✓ Reduce the load.
- ✓ Increase Pr63, or set Pr64 = 1.

Err.26 Over speed protection

Causes

- Servo motor rotation speed exceeds the maximum speed limit.
- Poor gain adjustment, resulting in Overshoot.

Solution

- ✓ Check the position command pulse frequency does not exceed the input limit.
- ✓ Check the input command electronic gear ratio is too large.
- ✓ Avoid fast speed command input.
- ✓ Re-adjust the gain settings to eliminate the Overshoot.

Err.29 Deviation counter over flow protection

Causes

- Deviation counter value exceeds 2^{27} (134217728)

Solution

- ✓ Check the servo motor is rotating along with the input position command.
- ✓ Check the servo motor wiring is correct UVW.
- ✓ Increase the gain setting.

Err.36 EEPROM parameter error protection

Causes

- Read data from the EEPROM, EEPROM data corruption parameters.

Solution

- ✓ Reset all the parameters, and stored in the EEPROM.
- ✓ The contents of the EEPROM restore to factory state.
- ✓ If repeated, shall replace the drive.

Err.37 EEPROM parameter error protection

Causes

- Stored in the EEPROM data corruption of CRC.

Solution

- ✓ Reset all the parameters, and stored in the EEPROM.
- ✓ The contents of the EEPROM restore to factory state.
- ✓ If repeated, shall replace the drive.

Err.36 Run inhibit input protection

Causes

- Pr04 = 0 时, CCW-LIMIT (CN I / F, Pin-9) and CW-LIMIT (CN I / F, Pin-8), both open to the COM-.
- Pr04 = 2, CCW-LIMIT and CW-LIMIT, one of which, with the COM-open.

Solution

- ✓ Check the pin CCW-LIMIT, CW-LIMIT and COM-connection of sensors, switches, power supplies and other wiring is abnormal.
- ✓ Check the I / F control signal power on sequencing.

Err.48 Encoder Z phase error protection

Causes

- Encoder cable exposure is not good, resulting in the Z-phase feedback voltage level differential signal or incorrect.

Solution

- ✓ Check SIG encoder connector is properly connected driver.
- ✓ Check the encoder cable, male and female connectors really connected whether loose or loose metal pin.

Err.49 Encoder Z phase lose protection

Causes

- Encoder one rotation, Z phase signal is not detected when a protective.

Solution

- ✓ Encoder components may fail, need to replace motor.

Err.48 Encoder Z phase double signal

Causes

- Encoder rotating a circle, more than once detected the Z-phase signal to produce a protective

Solution

- ✓ The motor shaft may be subjected to hit, pulling and other external stress, resulting in breakage of glass plate, need to replace motor.

Err.99 Over current protection (hardware)

Causes

- Driver output current exceeds the limit values.
- Servo motor power line contact is not completely, UVW between the short circuit or ground.
- Command input and Servo ON the same time or earlier.
- Driver failure or motor failure.
- Often in the servo motor rotates, turn on or turn off the Servo ON, leading to destruction of the dynamic brake relay.
- Servo motor and drive specifications do not meet.

Solution

- ✓ Check servo motor UVW connector for loose or exposed wire and short circuit, poor insulation and green lines.
- ✓ Servo ON after waiting for more than 100ms is required, before they can input command.
- ✓ Please remove the servo motor power cable, then input the Servo ON test. If an exception occurs immediately after Servo ON, necessary to replace the drive.
- ✓ Measure the line resistance servo motor is balanced, if the resistance of imbalance need to replace the servo motor.
- ✓ Do not use Servo OFF / ON control servo motor to stop or running.
- ✓ According to label instructions, to confirm the servo motor drive models and capacities are matched with each other.